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Arc-Lamp Improvements

Although the flame-electrode long-burning arc lamp has been used for half a dozen years, great improvements have been made in it recently, not only in the production of long-burning electrodes of fairly high efficiency but in the mechanical and electrical design of the lamps themselves. The long-burning flame lamp, desirable as it is, has presented a formidable series of problems not easy of solution. In the first place, the electrodes themselves require great attention. Long-burning and high luminous efficiency are in a manner opposing characteristics, and it is only as a result of tedious experiment that a really good compromise has been reached. In this more than anything else perhaps has the long-burning flame-arc lamp been improved. Carbon among all substances used for arc electrodes has the unique advantage of producing oxides that are gaseous, odorless and non-corrosive. All flame lamps yield a smudge of products of combustion which are much in evidence and often possess unpleasant characteristics. It has taken no small ingenuity to provide condensing chambers and suitable draft so as to carry the débris to a point where it will not interfere seriously with the light and with the mechanism of the lamp. The arcs produced are none too stable, and extremely good regulating mechanism is required to hold them to the point of efficient operation. This type of lamp, in short, is harder to regulate than the older arc lamps and consequently requires mechanism improved in delicacy to secure steadier operation of the arc, and in power to maintain this condition in spite of a somewhat troublesome tendency toward clogging.

Utility of the Porch Lamp

Consumers of electric energy in residences need to be taught the benefits of the porch lamp in countless cases where a few evenings' trial would be sufficient to establish this useful application beyond recall. The improved tungsten lamp has entirely changed the porch-lighting situation as regards cost and quality of service, and now that the 10-watt incandescent unit is on the market, there is little excuse for any well-equipped homes being without one. The porch lamp symbolizes in twentieth-century hospitality the old saying that "the latch string is out"; it saves time and temper on dimly illuminated suburban streets in a way that only the initiated appreciate, and it adds so little to the individual bill that it is within the means of everyone who entertains on even a modest scale. At a rate of 10 cents per kw-hr. such a lamp can be run practically all night for 1 cent. On screened-in sleeping or second-story porches where reading is a feature of the household life the cost is also low where higher-powered lamps are used for several hours an evening. The expense of wiring for a porch lamp is usually trifling, and while the revenue from each lamp is small for the central station, few devices better advertise the service. Even the small monthly energy consumption of the individual installation means business for the central station worth striving for when multiplied through whole neighborhoods. The supplementary effect on street lighting where lamps are few and far between or where foliage is dense is admirable. It ought not to be difficult to secure an income of from $1 to $3 per year from a porch lamp of moderate size, and it will pay to spend a little time and thought upon the solicitation of this kind of business in the right sort of neighborhoods.

The Tungsten Lamp Outlook

When, in 1909, the tungsten lamp was first seriously considered as a commercial product the electric-lighting industry little dreamed that in four years it would supplant the carbon-filament lamp, much less become an active competitor of the arc lamp. Representing as great an advance in the electric-lighting art as the Welsbach mantle did in the gas-lighting industry, it has outstripped the latter in the rapidity of its introduction and in its domination of the lighting field. This is merely indicative of the enterprise and progressiveness of one industry as compared with the other. However, the tungsten lamp was not then welcomed with open arms, nor was the drop in revenue which its introduction brought about pleasant to contemplate. Nevertheless, it acted as the incentive to spur managers to seek for more business to nullify its effect on earnings, and incidentally also it brought out the fact that there was a lot of business to be had merely for the asking, for up to that time only the surface had been skimmed. That the use of tungsten lamps has permanently affected the revenues of small companies has been proved by the fact that many have applied to commissions for permission to advance rates on that account. Meanwhile the manufacturers have been busy. Their best engineers and chemists have been at work on the evolution of an improved lamp, and success is in sight, if it has not already been attained. The lighting industry will, therefore, have to face the early probability of a greatly improved tungsten lamp whose introduction, though now seemingly remote, is nevertheless inevitable. Everything points to a shrinkage in revenue per lamp and to the necessity of earnest consideration of existing rate schedules in order that the revenue from lighting shall be commensurate with the service rendered. Far-sighted managers will appreciate the fact that any improvement which will cause the incandescent electric lamp to surpass all its competitors in the lighting field will ulti-

mately be advantageous to the industry even though it seem to demoralize it for the time being. It will lead to the universal use of electricity as an illuminant and will compel cheaper installations. It will also result in a more diversified application of electrical energy for heating, cooking and other purposes in the household. It will lop off the peaks of load curves and make isolated-plant loads more easy of attainment. In fact, the opportunities are immense; but so are the problems which the advent of the greatly improved lamp will present. Who knows whether the half-watt lamp of to-morrow may not become the quarter-watt lamp of the day after? It is not beyond peradventure. Anticipation of probabilities under such circumstances is entirely commendable.

The Control of Central Stations

Central-station plants are divisible into three classes: first, those controlled through some form of holding company, syndicate or other dominant financial factor; second, those that are held free from any connection with similar properties through the medium of a holding company or otherwise, and, third, the municipal plants. We have made a compilation showing the division of plants into these three classes by states in towns and cities of the United States of more than 1000 population. The results, published elsewhere in this issue, are full of significance to the electrical industry. The facts of leading importance shown by the statistics are that 48 per cent of the total number of central stations in these communities are independent of financial connections, close or remote, with other properties; that 29 per cent of the total number of plants are held under some form of syndicate or generally admitted financial control by well-known interests, and that 23 per cent of the total number of plants are municipal. The compilation deals only with the number of plants; in importance and output the plants held in some form of syndicate control rank first. The importance and output of the municipal plants place them in third or last rank. If the analysis had been extended so as to include communities of less than 1000 population, undoubtedly the number and the proportion of both independently owned plants and municipal plants would be larger. However, the compilation is based on the reports from a total of 4774 plants, and, therefore, it may be taken as fairly indicative of the present status of the industry in these respects.

The form of control of operating plants generally discussed as the holding-company movement or the syndicate movement is interwoven closely with the progress of the industry, and its extension in the future will follow substantially the same lines that it has in the past; that is to say, many different and widely scattered dominant financial interests, operating separately, will either acquire an actual majority of stock of operating companies and will vest the ownership of this stock in holding companies or they will acquire enough stock to enable them to determine financial and operating policies. While the general lines of development in this direction, therefore, are perfectly simple and plain, it is clear that, to a greater degree than in the past, the operations of many of the large factors in the industry are being extended to the plants of medium and even small size. Ordinarily the plants in the larger cities are held by interests which have been identified with their control for many years, and naturally they do not propose to divest themselves of their ownership unless they are tempted to do so by offers of a large price for their holdings. We find that in the cities of over 100,000 population 87 per cent of the plants are controlled by some form of syndicate, holding company or strong financial interest. The proportion is slightly smaller in the cities of between 50,000 and 100,000, being 84 per cent. In the cities of still smaller size the proportion of plants owned or controlled by syndicates becomes less. In the cities of between 10,000 and 50,000 population 63 per cent of the plants are held by syndicates. In the cities of the next smaller group, 5000 to 10,000 population, 44 per cent of the plants are held by syndicates. The proportion is reduced to 20 per cent in the cities of between 1000 and 5000 population.

The opportunities for the further extension of the advantages of consolidated ownership and operation therefore lie mainly in the smaller communities and increase in proportion as the sizes of the communities decrease. In closely settled districts of the country, where there are many towns or villages and a substantial rural population within a small area, the development in this direction within the last year or two has been epochal in nature. In such cases the object of the dominant financial factor has been virtually to preempt the district in which the operations were to be conducted. In other words, it was just as important to effect a monopoly in public-utility service in a large area containing many communities as it is admitted by public service commissions and electrical authorities to be in a large area containing a single community. The advantages in each case lie in centralized production on a large scale, in modern economical methods of transmission and distribution, and in the application of advanced commercial methods of sale of the service.

As we have shown, the proportion of syndicate-controlled plants is largest in the larger cities and smallest in the smaller communities; conversely, the proportion of independent plants is smaller in the large cities and large in the small cities. In the smaller communities, those which have between 1000 and 5000 population, the number of independent plants is 55 per cent of the total. The proportion of municipal plants is but 3 per cent in the larger cities. It increases as the size of cities in each group taken in the compilation decreases. In the communities of between 1000 and 5000 population the proportion of municipal plants is 25 per cent, and as the communities in this group furnish 3492, or 73 per cent, of the 4774 in the entire compilation, it is virtually this percentage which determines the conclusion that 23 per cent of all the plants in the compilation are municipal. Many small communities started and carried the burden of municipal plants when they did not have enough population to support private plants.

The statstics therefore show that through the purchase of small independent and municipal plants many opportunities may be grasped for the introduction and extension of the benefits of centralized production and economical distribution over a large area.

The Advance of Illuminating Engineering

The well-arranged combined meetings of the Illuminating Engineering Society and the International Congress on School Hygiene at Buffalo on Aug. 29 and 30, the forthcoming annual convention of the Illuminating Engineering Society at Pittsburgh Sept. 22 to 26, and the approaching seasonal increase in the lighting load on central stations, give emphasis to the advance in illuminating engineering practice noticeable increasingly during the past few years.

Although many examples of wretched lighting can be found in cities and towns of all sizes close beside installations of excellent design, the latter are coming more and more to the front. The advance of the art is being directed into many fields which are open for fresh and skilful applications of the latest equipment for effective service. Thus, an unusual amount of study is being given at present to the illumination of libraries, restaurants, theaters, hotel and art galleries; large and expensive railroad stations are being efficiently lighted along lines utterly unknown in the past decade of transportation, and in the street-railway field investigations are under way in respect to the fitness of tungsten lamps for car service which would have been practically out of the question before the advent of drawn-wire tungsten filament in commercial form. The production of small candle-power lamps of this style for use on 110-volt circuits has made great strides within the past two years, indicating the possibilities of better residential lighting. The beauty and utility of some of the latest art-glass fixtures represent a wide departure from former ideas regarding high quality lighting, and when used with discrimination and full recognition of the engineering elements involved, this sort of equipment literally furnishes the building designer with a new system of practical ornamentation capable of extraordinary usefulness.

With all that has been accomplished, however, much that is elementary remains to be learned before general lighting practice rises to a level of scientific efficiency corresponding to that now enjoyed in the field of electric-motor applications. More accurate surveys of installations existing and proposed are necessary and greater care should be exercised in checking data for subsequent reference. Too often designers called upon to submit estimates based upon former work are possessed of inaccurate figures regarding the number of lighting units placed in service subsequent to the initial installation, the wattage requirements and locations of lamps, and the permanent types of shades and dimensions settled upon by the plant owners as standard for their particular needs. The grosser errors of installing lamps and fixtures without due regard to glare, of forcing excessive and painful luminous fluxes upon inexperienced purchasers of light in the interests of publicity illuminations, and the omission of careful calculations as to fixed and operating costs, including renewals, taxes, insurance and depreciation under the former head, need to have more consideration, as do also the use of mixed equipments in conflict with one another and the economical mistreatment of otherwise excellent installations through insufficient outlays for circuit subdivisions. Taken in the rough, the progress of illuminating engineering is at present in an extremely healthy condition, and if the well-established principles of good practice are spread through the ranks of engineers at the rate indicated as one looks backward over recent work, the realization of still greater achievements will not be long delayed.

Efficiency and Effectiveness of Reflectors

Much valuable information concerning the efficiency and effectiveness of various types of incandescent-lamp reflectors is contained in an article by Messrs. G. H. Stickney and A. L. Powell, on page 477 of this issue. The authors report the result of a series of tests relating to the total luminous flux and space distribution thereof from clear and bowl-frosted tungsten lamps with and without standard forms of opaque, opalescent and clear-glass reflectors. As one would expect, the opalescent and clear-glass reflectors are most efficient, the loss by absorption being as low as 8 per cent in the case of the former and 9 per cent with the latter, as compared with from 14 to 43 per cent in opaque reflectors. It may prove surprising to some to learn that, although the metal type of reflector is the least efficient of all, yet it is the most effective from the point of view of re-direction of the light to the lower hemisphere. Results of the test indicate for the flat-dome reflector with porcelain enamel finish a total of 785 downward lumens as compared with only 626 for the most efficient opalescent-glass reflector and 717 for the best grade of prismatic-glass reflectors tested. This result is attributable to the higher reflective coefficient of the porcelain enamel as compared with the glass prisms. In this connection sight should not be lost of the important fact that when use is made of glass reflectors much of the light not reaching the lower hemisphere is useful for illumination throughout the upper hemisphere. For this purpose credit must be given to the prismatic reflector for 91 lumens, while only 35 lumens are to be credited to the flat-dome porcelain-enamel reflector.

Not the least important feature of the tests discussed by the authors is the necessity for correctly locating the lamps within the reflector and proportioning the reflector for the lamps. Marked changes in the space distribution of the light flux are produced by simply varying the position of the lamps with reference to the reflector. In designing a prismatic reflector full account must be taken of the fact that the light source is not concentrated at a point. To neglect of these considerations doubtless may be attributed much of the decrease in efficiency and effectiveness of certain prismatic reflectors tested by the authors. Even with the downward lumens at as low a value as 590 compared with 717 lumens for other types of prismatic reflectors, the efficiency is as high as 86 per cent as compared with 91 per cent for the more carefully made reflector. Thus the loss in effectiveness is attributable more largely to improper re-direction than to absorption of light. A factor in service not touched upon by the authors is the added light absorption with accumulation of dust. Pronounced differences in this respect are found in different types of reflectors. Doubtless reflectors depending for increased efficiency upon the light passing into the upper hemisphere suffer from dust accumulation more than do those of the opaque type.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Growth of Public-Control Sentiment

In his address before the Governors' conference at Colorado Springs on Aug. 29 Governor Dunne of Illinois spoke on "The Growth of Public Control of Utilities." He traced the history of the movement from 1905 (when Massachusetts was the only state having state control of utilities) to 1913. Now there are twenty-two states having state utility commissions. The Governor praised the Wisconsin law, but said that it fails to cover situations arising in other states, like New York, Pennsylvania and Illinois, where there are large cities. He said that he was in sympathy with the home-rule sentiment in Chicago, but was confronted with the alternative of approving or vetoing the Illinois act, without the home-rule section, as passed by the Legislature. He finally determined that it was his duty to sign the bill. The Illinois law is framed on the lines of the Wisconsin law, with two material changes—publicly owned utilities are excluded from the jurisdiction of the commission and there are no indeterminate franchises. Only three states, Ohio, California and Kansas, provide for home rule of utilities where there are state commissions. Governor Dunne is satisfied that the Illinois law gives adequate and complete control to the state commission and that it "will do much to correct the scandalous abuses which have afflicted the public in the past, owing to the absence of any control over these utilities." Probably every state will have a public-utility commission within a few years. If public control should fail, then the only alternative left is public ownership and operation.

H. M. Byllesby on Regulation

In a letter referring to the payment of the next dividend on the preferred stock of the Standard Gas & Electric Company in scrip instead of in cash, Mr. H. M. Byllesby, the president, refers to regulation by public service commissions as follows:

"During the past several years, and particularly in the eighteen months just closed, the subsidiary companies of the Standard Gas & Electric Company have been under the necessity of appearing before various regulatory bodies, in some cases for the purpose of resisting unfair increases in taxation, in other cases for arguing the question of rates and of necessity for extensions to their properties, in other cases dealing with threatened competition and appeals to such regulatory bodies for the proper degree of protection. All this has caused large expense to Standard and its subsidiary companies for legal advice, traveling expenses and the cost of expert and technical witnesses, which has had its effect upon the earnings of the subsidiary companies. So far these companies have emerged from these controversies with credit to themselves, and, aside from the marked increase in taxes, with a more satisfactory working condition than had heretofore existed.

"The attitude of your officers and of the officers of Standard's subsidiary companies has uniformly been to deal in a spirit of candor with the various commissions and regulatory bodies before which it is increasingly necessary for public utility officers to appear, and, so far as our experience goes, the attitude of these commissions and regulatory bodies ameliorates and improves as these bodies become better acquainted with the problems which concern the utility companies and as they become personally acquainted with the organizations of those companies and with the sincerity and frankness of their procedures."

Old Time and Military Telegraphers

The annual joint reunion of the Old Time Telegraphers and Historical Association and the Society of the United States Military Telegraph Corps was held in Detroit on Aug. 26 to 28, with headquarters at the Hotel Cadillac. About 250 ladies and gentlemen were present. These annual gatherings of the veterans of the key are mainly social in character, but at short business meetings Mr. George M. Meyers, of Kansas City, was elected president of the Old Timers, and Colonel William Bruder Wilson, of Holmesburg, Pa., was re-elected president of the Military Telegraphers. The entertainment features consisted of an automobile ride through Detroit and suburbs, a steamboat excursion on the Detroit River and an electric-railway trip to Mount Clemens, where the local Chamber of Commerce gave a reception to the visitors. At the banquet of Aug. 28 Mr. W. A. Jackson, of Detroit, was toastmaster, and the principal address was made by Governor W. N. Ferris of Michigan.

Membership Campaign of the Society for Electrical Development

According to Mr. J. M. Wakeman, general manager of the Society for Electrical Development, responses in the campaign for members have been numerous and very gratifying. Quite a number of responses, however, indicate that some men are willing to trail along and join the society at the last moment, rather than be pioneers in the greatest co-operative movement of this time.

This attitude will not prevent the society from becoming a practical reality, both because its work is recognized as a real necessity in the electrical field and because the leading electrical concerns are members of it and will inevitably put it into action. It simply postpones the time when the electrical industry will get the benefit of the immense amount of time and thought already devoted to the work of the society.

Some men have said that the electrical industry develops itself automatically, yet, according to Mr. Wakeman, 80 per cent of the houses within serviceable reach of the central stations are not even wired, and not 1 per cent of those which are wired are equipped for complete electric service.

The work which the society will do is a kind which needs doing and which no individual or corporation can afford to do singly. It will directly stimulate the public demand for electric service, which means the development of the industry as a whole, which in turn means increased prosperity to every individual engaged in it.

The educational campaign will be nation-wide. It will remove the mistaken opinion regarding the extravagance of electricity. It will show that electricity is the only commodity of daily use which has constantly been reduced in price at a time when the cost of every other necessity in life has increased. It will not be merely an advertising

campaign. The society has a great work to perform in harmonizing, wherever possible, conflicting local interests.

All the movement needs to set it at work at once is a full appreciation upon the part of the men in the electrical industry of the progressive spirit in which it has been conceived, and it is evident from the number of applications coming in that this spirit is rapidly becoming recognized.

The Society for Electrical Development proposes at small individual expense to bring big returns in increased business, better prices and larger profits to those who participate. It is collecting funds to enable the men engaged in the electrical industry to put some of their dollars to work co-operatively to develop in a big, broad spirit the latent market.

Convention Program of the Association of Edison Illuminating Companies

The thirty-fourth convention of the Association of Edison Illuminating Companies will be held at the Hotel Otesaga, Cooperstown, N. Y., Sept. 8, 9, 10, 11 and 12. The program is as follows:

Address of the president.

Report of the executive committee.

Report of the treasurer.

Report of the meter committee; Mr. S. G. Rhodes, chairman, New York.

Report of the committee on heating; Mr. E. W. Lloyd, chairman, Chicago, Ill.

"The Central Station and Industrial Electric Heating," by Mr. Thomsen King, Baltimore, Md.

"One Year's Activity by the Boston Edison Company in Promoting the Use of Energy-Consuming Devices and the Results," by Mr. L. L. Edgar, Boston, Mass.

"Possible Fire Hazards in Service Connections," by Mr. J. B. Murray, Brooklyn, N. Y.

"Some Notes on Welfare Work," by Mr. H. W. Moses, Boston, Mass.

"Welfare Work at the Works of the General Electric Company," by Mr. G. E. Emmons.

"Corporation Schools," by Mr. F. C. Henderschott, New York, N. Y.

"Private Conservation for Public Benefit," by Mr. George C. Holberton, San Francisco, Cal.

Report of the lamp committee; Mr. John W. Lieb, Jr., chairman, New York. Prepared discussions by Messrs. R. S. Hale, J. W. Howell and others.

"Latest Developments in Incandescent Lamps," Mr. John W. Howell, Harrison, N. J.

Report of the vehicle committee; Mr. G. H. Jones, chairman, Chicago, Ill.

Report of the storage-battery committee; Mr. S. C. Harris, chairman, New York.

"Modern Electric Drive and What It Accomplishes in the Ice-Cream, Glass-Bottle and Fertilizer Industries," by Mr. R. H. Tillman, Baltimore, Md.

Report of the code committee; Mr. R. S. Stewart, chairman, Detroit, Mich.

"Load-Factor," by Mr. A. S. Loizeaux, Baltimore, Md.

"Sixty-Cycle Rotary Converters," by Mr. B. G. Lamme, East Pittsburgh, Pa.

"A New Apparatus for Catching Cinders," by Messrs. C. B. Grady and E. B. Ricketts, New York.

"Notes on the Further Operation of Large Boilers of the Detroit Edison Company," by Mr. J. W. Parker, Detroit, Mich.

Report of the committee on steam turbines; Mr. J. P. Sparrow, chairman, New York.

Report of the committee on high potentials; Mr. L. L. Elden, chairman, Boston, Mass.

"Circuit Protection," by Mr. Paul M. Lincoln, East Pittsburgh, Pa.

"Recent Improvements in the Protection of High-Voltage Transmission Circuits," by Mr. F. E. Ricketts, Baltimore, Md.

Address on the model public utility bill by Mr. E. W. Burdett, Boston, Mass.

"The Proper Basis of Valuation of Property in Rate Cases," by Prof. D. C. Jackson, Boston, Mass.

It is expected that an address will be made by Mr. S. E. Doane, of the National Electric Lamp Association, who will outline his observations upon the more recent electric developments in Europe made during a very extensive trip. An exhibition of some of Mr. Edison's latest developments in educational and industrial films, his new phonographic records, and possibly other important features of his work, is also an anticipated feature. Abundant entertainment features are provided for every day the convention is in session. It is expected that Mr. and Mrs. Edison will be present at the reception on the evening of Sept. 8.

Convention of the Pennsylvania Electric Association

The sixth annual convention of the Pennsylvania Electric Association will be held on Sept. 16, 17 and 18 at the Water Gap House, Delaware Water Gap, Pa. As heretofore, a number of entertainment features have been arranged to provide diversion during the time not devoted to the convention sessions. The following is the tentative program: Report of the lamp committee; report of the committee on welfare work; report of the public utility interconstruction committee; "Rates," by Mr. L. H. Conklin; "Rules and Regulations for Outside Employees," by Messrs. S. W. Brown and J. A. Metz; "Rules and Regulations for Station Operation," by Mr. I. G. Walborn; "Boiler-House Practice," by Mr. S. G. Coghlan; "Feeder Regulators," by Mr. A. D. Fishel; "Street Lighting," by Mr. Preston S. Millar, and an address on the recently enacted public service company law by Mr. Frederic W. Fleitz, a well-known corporation lawyer of Pennsylvania. Mr. Walter E. Long, 1000 Chestnut Street, Philadelphia, Pa., is the secretary of the Pennsylvania Electric Association.

Fourth Annual Meeting of California Contractors

The fourth annual meeting of the California State Association of Electrical Contractors began at Santa Barbara on Aug. 13, the registered attendance being 120. President Rendler in his annual address stated that he expected the association to make great strides during the coming year. The following committees' reports were presented: segregation, jobbers', liability insurance, state license, price book, and director to the national convention.

During the meeting of Thursday morning the report of the auditing committee was received and a special committee on liability insurance was appointed. Clippings from the *Electrical World* with reference to guaranteeing the work of members of the association were read. The secretary reported that this matter was being handled by the executive board of the National association, and also that a plan was being tried by the Faraday Club of Chicago. The subject was referred to the executive board. The election of officers resulted as follows: President, Mr. C. V. Schneider, of Sacramento; first vice-president, Mr. Claude Loveday, Santa Barabara; second vice-president, Mr. George Sitman, San Francisco; secretary nad treasurer, Mr. W. S. Hanbridge, San Francisco; sergeant at arms, Mr. Frank Somers, San José.

The meeting of Aug. 15 was devoted to the reading of papers. Mr. A. H. Halloran gave a talk on the work that was being done by the Society for Electrical Development, and Mr. Huntington, manager of the Santa Barbara Light

& Power Company, spoke on "Mutuality of the Central Station and the Contractor." Mr. C.A. Austin, chairman of the Los Angeles Chapter of Architects, also read a paper, and Mr. Ralph Clapp, statesman from Southern California, spoke on Jovianism. Mr. P. B. Hyde, of the Edison Primary Battery Company, gave a short talk on the necessity of installing fire-alarm systems in hotels and office buildings. The final paper of the day, on "Liability and Compensation Insurance," was presented by Mr. J. R. Malony, the Western manager of the Ætna Insurance Company. This subject was very well timed, as on Jan. 1, 1914, a very drastic compulsory insurance law will become effective in California.

A short session of the contractors was held after the reading of the papers, at which time Sacramento and San Francisco were chosen as the places for the 1914 and 1915 conventions respectively. It was also voted to establish a committee of experts to be at the disposal of architects when disputes arise. The directors were instructed to establish a sample room in their respective cities, at which the architects could visit and see the different appliances that go to make up good construction. Much attention was attracted at this convention to the bookkeeping set recently brought out by the National Electrical Contractors' Association. A Spanish barbecue, a ball game, rides for the ladies and Jovian activities helped to take up the time not spent in the convention sessions.

Commonwealth Edison Company Protests Against City's Valuations

The Commonwealth Edison Company of Chicago has protested against the valuations placed on its property in the report made by Mr. Ray Palmer, city electrician, for the purpose of regulating electric rates. The company's counsel declares certain investments were excluded, among others an investment of about $400,000 in coal property, while the important questions of going value, good will and municipal franchises were slighted. Inasmuch as the company has reduced its rates voluntarily when it was possible, it contends that there is no occasion for the city taking legal means to reduce the rates. Copies of the statement were sent to the members of the City Council committee on gas, oil and electric light. The Commonwealth Edison Company's discussion of the Palmer report will be considered when the Council committee meets again in October.

Plans for Convention of New England N. E. L. A. Section

The fifth annual convention of the New England Section of the National Electric Light Association will be held at the Hotel Vermont, Burlington, Vt., from Sept. 17 to 19, inclusive. A large attendance is anticipated in view of the attractions of the business and social program and of the Lake Champlain district at this season, when the foliage of the Green Mountains is at its height in autumnal coloring. The largest delegation will probably leave Boston on special cars attached to the 11 a. m. train on Sept. 17, via the Rutland Railroad, and this party will be in charge of Mr. Leavitt L. Edgar, master of transportation, 39 Boylston Street, Boston, Mass.

The business sessions will begin at 10 a. m. Sept. 18 and will be four in number. The papers to be presented are as follows: "Problems of Central-Station Managers in Cities of Less Than 5000 Inhabitants," by Mr. A. B. Marsden, Manchester, Vt.; "Principles Governing Central Stations in Line Extensions and Various Commission Rulings Thereon," by Mr. Alexander Macomber, C. H. Tenney & Company, Boston; "Some Phases of the Merchandising of Electric Appliances," by Mr. W. G. Stetson, Boston Edison company; "The Value of the Electric Vehicle to the Central Station," by Messrs. W. H. Snow and David W. Beaman, New Bedford (Mass.) Gas & Edison Light Company; "Co-operation of Allied Electrical Industries," by Messrs. S. St. John Morgan, Westinghouse Electric & Manufacturing Company, Boston, W. J. Keenan, Pettingell-Andrews Company, Boston, J. G. Gilliland, New England Engineering Company, Waterbury, Conn., and Francis A. Gallagher, Jr., Narragansett Electric Lighting Company, Providence, R. I.; "The Relation of the Central Station to Its Customers," by Mr. J. T. Shannon, United Electric Light & Water Company, Waterbury, Conn.; "Lamp Voltage and Socket Voltage," by Mr. Henry Schroeder, General Electric Company, Harrison, N. J. Abundant entertainment features have been provided.

Jovian Co-operation in Electrical Development Society's Membership Campaign

The 12,000 Jovians in the United States and Canada are at present actively engaged in a co-operative campaign to increase the membership of the Society for Electrical Development, Inc. As an incentive to those who are lending their assistance in this movement the board of directors of the Society for Electrical Development has authorized the payment of the following cash prizes for memberships secured between Aug. 15 and Sept. 30: $500 to the Jovian league securing the largest number of members, $250 to the individual Jovian securing the largest number of members, $150 to the individual Jovian securing the second largest number of members, and $100 to the individual Jovian securing the third largest number of members.

Historical Review of the Keokuk Hydroelectric Development

An interesting feature of the celebration which opened the great hydroelectric plant of the Mississippi River Power Company at Keokuk, Ia., Aug. 26, was the history of the efforts made to develop this water-power, read by Mr. William Logan, of Keokuk.

Mr. Logan said that as far back as 1848 a company was formed to utilize the water-power of the Des Moines Rapids, estimated at 200,000 hp. No success attended the effort, which was ultimately abandoned. In 1868 the United States government began the construction of a navigation canal around the rapids, the canal being completed in 1876. In the following years several organizations were formed to build a power canal or wing dam on the Illinois side of the river, but all grants or permits lapsed prior to 1899.

On July 7, 1899, a number of the citizens of Keokuk, Ia., and Hamilton, Ill., Mr. Logan being one of the number, organized the Keokuk & Hamilton Water Power Company with a capital stock of $2,500. In 1901 this company procured from Congress a franchise to build a wing dam, or power canal, on the east side of the rapids not over 500 ft. wide. The company then secured the services of Mr. L. E. Cooley, the well-known hydraulic engineer of Chicago, who reported that the cost of the wing-dam project, considering the amount of energy to be utilized, was prohibitive. Mr. Cooley concurred with Major Montgomery Meigs, civil engineer in the United States government service, who had suggested a dam across the river.

Another year passed and the funds of the company were exhausted. It was, however, determined to go ahead on the new plan of building a dam from shore to shore. Senator Allison, of Iowa, was appealed to for advice, and finally Congress passed a resolution directing the Secretary

of War to appoint a board of engineers to investigate the project. This board consisted of Col. Alexander McKinzie, Lieut.-Col. H. E. Hodges, Capt. Edward Burr, Capt. Charles McKinstry and Capt. William B. Judson. Col. Hodges was chairman. In its report the board of engineers held that the project was feasible and practicable, and that as proposed it would be an aid to navigation. The point was

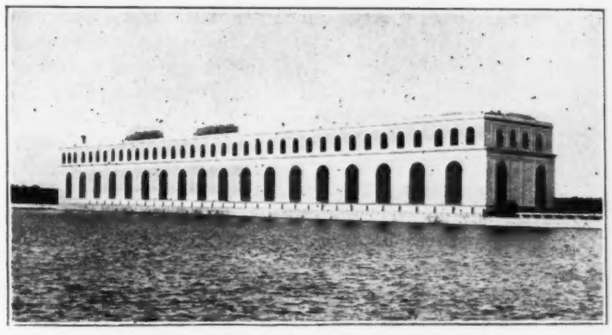


FIG. 1—POWER HOUSE, KEOKUK HYDROELECTRIC DEVELOPMENT

made that if private capital were disposed to aid in the improvement of navigation without expense to the government, no objections should be made by the government. The engineers' report was made public in 1903. Mr. C. P. Birge, of Keokuk, the president of the company, died in that year. Mr. Logan spoke of him as the father of the enterprise.

Mr. Logan gave in some detail the history of the unanimous passage of the bill by Congress early in 1905, giving the Keokuk & Hamilton Water Power Company the right to build a dam across the river.

Early in September, 1905, the stockholders received a telegram from New York signed by Hugh L. Cooper, asking for an appointment. This was arranged, and the committee accompanied Mr. Cooper to Niagara Falls, where he was then building a water-power plant. In Toronto on Sept. 15, 1905, the committee entered into a contract with Mr. Cooper, as the agent of a syndicate of capitalists, giving them a two-year option on the stock and franchise. Nothing was done during the ensuing fall and winter except that Mr. Cooper prepared plans and specifications for the tentative approval of the Secretary of War.

Mr. Cooper came to Keokuk in the spring of 1906 and

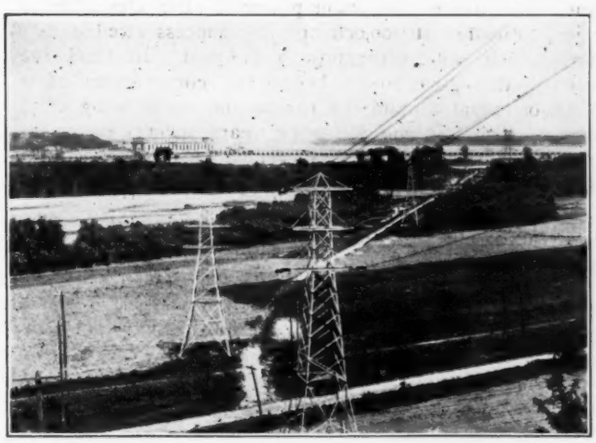


FIG. 2—POWER HOUSE, DAM AND TRANSMISSION LINE, KEOKUK

brought with him a corps of engineers who made the necessary surveys and contour lines showing areas to be flooded. The year 1907 was a year of financial disturbance and nothing was done. The hearts of Messrs. Johnstone, Logan and Dadant, the Keokuk promoters, grew sick with hopes long deferred. In June, 1907, the Toronto syndicate abandoned the enterprise under the terms of the option.

On July 8, 1907, the Keokuk men entered into a new option with Mr. Hugh L. Cooper personally, which was to expire Dec. 31, 1908, but was extended to expire Feb. 1, 1910. Mr. Cooper did a prodigious amount of work during the years 1907 and 1908 to induce capitalists to join him in the undertaking. Mr. W. V. N. Powelson, then president of the Union Electric Light & Power Company of St.

FIG. 3—NIGHT VIEW OF POWER HOUSE, KEOKUK

Louis, resigned that position in 1908 and became a partner of Mr. Cooper, the firm being Cooper & Powelson. In October, 1908, Mr. Cooper and the Keokuk & Hamilton Water Power Company made a contract with the Mississippi River Power Distributing Company, the Union Electric Light & Power Company, the United Railways Company and the Laclede Gas Light Company, all of St. Louis, for the sale and purchase of 60,000 electrical horse-power to be delivered in St. Louis. This appears to have been the turning point of the enterprise.

The stock, franchise and property of the old company were turned over to Mr. Cooper and the company was reorganized by the election of a new board of directors consisting of Messrs. Hugh L. Cooper, W. V. N. Powelson, W. J. Curtis and J. P. Allen, of New York; John Hunter and J. H. Drabelle, of St. Louis, and William Logan, of Keokuk. Mr. Cooper continued indefatigable in the difficult task of interesting capitalists. Under the terms of the franchise actual construction was to begin on or before Feb. 9, 1910, or the grant would lapse.

In the latter part of 1909 Mr. Cooper took the matter up with Stone & Webster, of Boston. Representatives of that firm came to Keokuk to look the situation over and reported favorably. On Jan. 8, 1910, Mr. Cooper received a telegram from Stone & Webster, saying that they would put up the money to start the work and would organize a company to carry it through to completion. On Jan. 10, 1910, just thirty days before the franchise expired, work was commenced, and it continued uninterruptedly until the last shovel of concrete was put in place May 31, 1913.

FIG. 4—GENERATOR ROOM IN POWER HOUSE, KEOKUK

In the spring of 1911 the Mississippi River Power Company succeeded the Keokuk & Hamilton Water Power Company, and it is now the owner of the entire plant and equipment. The dam, power house, lock, dry dock and appurtenances combined constitute the largest water-power plant in the world, the concrete construction being exceeded only by that in the Panama Canal. The total cost when fully equipped will be about $30,000,000.

Mr. Logan gave some interesting statistics. The total length of the dam, power house, lock, dry dock and sea wall, forming the dam complete, is about 9000 ft. The dam itself is 4278 ft. long. The power house is 123 ft. wide and 133 ft. high. When ultimately completed it will be 1718 ft. long. It is now about 900 ft. long. There will be thirty generators with vertical shafts, each driven by a turbine waterwheel and rated at about 10,000 hp. Fifteen of these units are now in place, although two of them are not yet in operation.

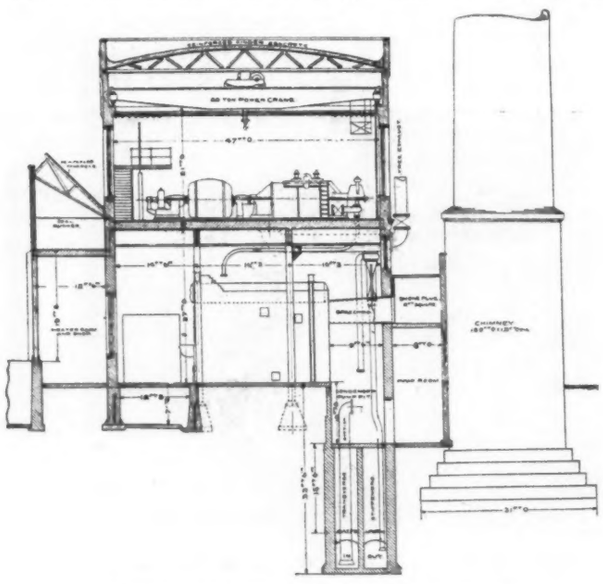
During the construction work and up to Aug. 26, 1913, there were used 232,706 cu. yd. of sand, 554,785 cu. yd. of crushed stone, 565,000 cu. yd. of concrete, 2,832,096 sacks of cement, 21,997 tons of steel, 289 tons of dynamite and 8,000,000 ft. of lumber. The excavation consisted of 586,869 cu. yd. of rock and 700,947 cu. yd. of earth.

A transmission line extends to St. Louis and is 137 miles long, the initial voltage being 110,000 volts. A transmission line to Burlington, Ia., has been built but is not yet in service.

A number of articles have appeared in the *Electrical World* descriptive of the Keokuk plant. The latest and most comprehensive appeared in the issue of May 31 last. Herewith are given some reproductions of photographs taken since then.

Passing of the "Double-Deck" Station at Fort Wayne, Ind.

The electrical energy for the operation of the interurban and trolley cars, lamps and motors on the circuit of the Fort Wayne & Northern Indiana Traction Company has in the past been generated in what is commonly known as a "double-deck" station at Fort Wayne, Ind. In the past the



SECTION THROUGH DOUBLE-DECK STATION

opinion has been held by some engineers that from the standpoint of steam economy the double-deck arrangement with the turbine directly over the boilers gave a type of design which was as nearly as possible theoretically correct, but in the course of work of rehabilitation at Fort Wayne this double-deck feature will be entirely done away with.

The excavation and the concrete work for the 40-ft. by 100-ft. addition which is to be made to the front of the building are now under way. In the completed plant all turbines will be set on the ground floor, the two 25-cycle machines which are now over the boiler being moved down and placed beside two new 6250-kva, 4000-volt, three-phase, four-wire General Electric turbo-generator sets which have recently been purchased. The new machines will be fitted with directly connected exciters, and in addition a turbine-driven exciter will be installed for break-down service. All turbines, feeder circuits and oil switches will be remotely controlled from a benchboard. The present jet condensing equipment will be taken out and the entire plant operated on Worthington surface condensers. Two 500-kw rotary converters now in the plant will be taken out and shipped to substations, and in their stead will be installed two 1000-kva synchronous motor-generator sets. The switchboard will be entirely new and all switching apparatus on the board will be installed in duplicate to insure as far as possible continuity of service.

When the plant is completed the entire system will be changed from two-phase, 2200-volt to three-phase, 4000-volt four-wire operation. According to present plans, the change in phase will be effected by means of transformers installed on one feeder circuit at a time, and the motors of the customers will either be exchanged or rewound and replaced. However, the saving in copper will much more than balance the expense incurred in changing customers' motors.

Sargent & Lundy, of Chicago, Ill., are the engineers for the redesign of the station.

Illumination Topics at International School Hygiene Congress

During the last two days of the International Congress on School Hygiene held at Buffalo, N. Y., Aug. 25 to 30, joint sessions were held with the Illuminating Engineering Society, subjects of schoolroom lighting being discussed by the educators and illuminating engineers present. The meetings were held at the City Hall, and an exhibit was arranged at the Broadway Auditorium, where copies of the I. E. S. "Illumination Primer" and booklet on "Glare" were available for distribution. The American Association for the Conservation of Vision also exhibited glazed and unglazed papers and blackboards, illustrating glare from reflecting surfaces.

Dr. Herbert E. Ives, Philadelphia, presided at the meetings, and in the absence of Mr. E. L. Elliott, New York, opened the Friday afternoon session with a brief talk on the subject of the "Illumination Primer," which he illustrated with lantern slides.

Ocular Hygiene

In the absence of Dr. E. M. Alger, of New York City, his paper on "The Relation of Illumination to Ocular Hygiene" was read by Dr. Roeber, of Philadelphia. The paper was a general résumé of the effects of bad lighting as far as definite statements can be made at present. Bright sources, it was shown, are detrimental owing to the exhaustion of the photo-chemical process essential to vision. In fact, permanent blindness can be caused by focusing the sun's image on the retina. Adaptation was declared to be very important, for bright light sources blunt the retinal sense while faint sources produce the reverse effect. Flickering light is harmful, especially when the flicker is so rapid that retinal adaptation cannot follow the fluctuations. The author impressed the desirability of proper arrangement of schoolroom desks and explained the principles of the eye parts. In closing, he made the statement that while day-

light is the most pleasant to the eye, there is no doubt that innumerable cases of very bad day-lighting exist.

VISUAL EFFICIENCIES OF LIGHTING SYSTEMS.

Prof. C. E. Ferree, Bryn Mawr, Pa., followed with a paper on "The Efficiency of the Eye Under Different Systems of Lighting," in which he described recent experiments with daylight, indirect, semi-direct and direct lighting systems. He is carrying on work with various systems, taking as a measure of comparison the loss in visual efficiency by means of a method previously described. The tests lasted two and three hours and the results show scarcely any loss in visual efficiency under daylight and indirect lighting, although a comparatively large decrease was noted under the semi-direct and direct systems. The fatigue seemed to be muscular rather than retinal. It must be remembered that Prof. Ferree's results apply only to the particular installations he used, for it can hardly be supposed than an ideal direct system would be more fatiguing than a bad case of day-lighting. The most favorable intensity found with the semi-indirect system used was 1.7 ft.-candles on the horizontal plane, which also gave 1.23 ft.-candles on a 45-deg. plane and 0.4 ft.-candle on the vertical plane. At the intensities commonly used semi-direct lighting was found practically as fatiguing as the direct system. For the latter the intensity causing least fatigue or loss in efficiency of the eye was 1 ft.-candle on the horizontal plane, which also gave 0.34 ft.-candle on the vertical plane. In all cases clear tungsten lamps were used.

Joint discussion of the three papers followed.

DISCUSSION ON OCULAR EFFICIENCY

Dr. Schereschewsky declared that amber glasses are not as good as green glasses. Dr. Roeber, of Philadelphia, objected to the use of anything but a neutral-tint glass except in very special cases. Dr. F. Park Lewis stated that glare should be avoided, on the psychological ground that when it is difficult to see it is difficult to think. Dr. Roeber then called attention to Nature's protection of eyesight by evolving the upper and lower portions of the retina of various animals to meet their condition of living.

Dr. Miles Standish, Boston, Mass., cautioned the public against accepting laboratory tests too completely, stating that more persons complained to him of indirect systems than of any other. He qualified his remark, however, by saying that they often complained for less cause in these cases. Dr. James Kerr, ophthalmologist of the London County Council, thought that results often depend on the standard of measurement and wondered what results Professor Ferree would have obtained had he used as his criterion the threading of a number of needles in a given time. He further emphasized the importance of retinal adaptation. Asked regarding the relative cost of indirect and direct lighting, Professor Ferree stated that he had obtained better illumination in point of uniformity and intensity with the indirect system than with the direct using the same lamp wattage, a result contrary to general experience. Mr. G. H. Stickney, Harrison, N. J., called attention to the inadequacy of designating lighting systems as "direct," "indirect," etc. There are many kinds of direct lighting. In fact, the distribution from a bare lamp often differs but little from that obtained with a large diffusing sphere. He suggested that so far as the results of Professor Ferree's work relate to direct, indirect and semi-direct systems, the question be left open.

GLARE FROM PAPER

Mr. M. Luckiesh, Cleveland, Ohio, next presented a paper on "Glare from Paper" in which he described the influence of glazed paper in destroying the good effects of a well-designed lighting system. He referred to the work of the society's committee on glare from reflecting surfaces, of which he is chairman. Attention was also called to the exhibit booth illustrating glare from polished surfaces, and glare from paper was next analyzed, showing how the ability to read is interfered with by the elimination of contrast between the paper and printed matter. The analysis showed that a decrease in intrinsic brightness of the light source results in an actual decrease in glare from the paper and an increase in the ability to read.

EFFECT OF BLACKBOARDS ON ILLUMINATION AND GLARE

Dr. Mathilde Gstettner, assistant oculist of the Vienna Polyclinic High School, next read a paper on "The Influence of Blackboards' Position on the Lighting of Desks." After a description of some of the retinal processes of vision she described measurements on desks with the blackboards raised and lowered. When in the normal position it was found that the outlying desks were illuminated less brightly than when the blackboards were raised. Experiments with various wall coverings were also described.

Dr. Roeber, of Philadelphia, said that the Pennsylvania commission recommends the use of matte paper and the pasting of a slip in the front of each school-book giving directions regarding holding the book and the position to be taken relative to the light sources.

Mr. Luckiesh described his experiences in inspecting conditions in schoolrooms, concluding that it is in many cases difficult to avoid glare due to regular reflection from blackboards when light comes from side windows. He recommended tilting blackboards downward in some cases, but suggested ultimately the use of matte-surfaced blackboards.

Dr. Kerr stated that the influence of blackboards in decreasing illumination is greatest near the boards, as Dr. Gstettner stated, and hence was a serious matter. He recommends high illumination on the blackboards. It was suggested by Dr. Lewis that white paper and black crayon be employed, unrolling fresh surfaces as needed, in "paper-towel" fashion.

SCHOOLHOUSE LIGHTING

The session of Saturday morning was opened by Dr. D. W. Weaver, of Greensburg, Ind., who read a paper on "Schoolhouse Lighting." The author described his work in this field as a commissioner of health, and declared that he favored diffused daylight as the best means of illumination. He emphasized the disadvantages of light from windows and strongly advocated the use of skylights with prismatic glass placed horizonally near the ceiling. The eyebrows and other anatomical features, he said, protected the eye from light falling from above. Dr. Weaver also expressed belief that direct and indirect lighting are equally advisable when properly designed.

Dr. James Kerr, of the London County Council, next presented his paper on "The Illumination of Classrooms." He drew attention to the great variability of the absolute intensity of daylight and the relatively wide variation in illumination found in different parts of the same room. He said he thought the practical test of illumination must measure its adequacy for visual work. Someone has proposed an empirical criterion which stamps an illumination as satisfactory when ordinary type can be seen through a smoked glass which absorbs 96 per cent of the light. He called attention to two kinds of glare—one that causes permanent physical changes in the eye media and another which causes only temporary discomfort. Twenty per cent of the pupils examined by him showed acuity below normal, while 10 per cent were only one-third of normal. He gave rules regarding the angle of the sky that should be suntended by the window and stated that the lower sky line should not be lower than 25 deg. from the horizontal line to the eye. He further pointed out that heating and ventilating requirements affect the size of the window, and he called attention to the effects of adjacent buildings, suggesting that the lower floors have higher ceilings than the upper floors in order to compensate for the latter's advan-

tage. The committee of the British Illuminating Engineering Society has decided that 2 ft.-candles is the minimum artificial illumination advisable, and that 4 ft.-candles is necessary for reading. Only 1 ft-candle is believed necessary, however, where no reading or writing is to be done. He said he thought the best results in artificial lighting are obtained by semi-direct units where the opal globe is not appreciably brighter than the surroundings. In closing the speaker strongly advised a minimum illumination of not less than 2 ft-candles.

In the absence of Mr. B. B. Hatch his paper on "Schoolhouse Lighting from the General Standpoint of an Engineer" was not read.

Discussion on Schoolroom Illumination

In discussion, however, Mr. G. H. Stickney said that to have too much light coming directly from above is inadvisable, although prismatic glass changes the direction of the skylight rays satisfactorily. Dr. Weaver said that glazed surfaces are not so serious with overhead lighting, and he strongly advocated general illumination. Mr. Rowe suggested the use of wax finish for all schoolroom furniture. Another member declared that overhead skylighting is found satisfactory in a school which he inspected. He added that brown, depolished blackboards were both satisfactory and artistic. Mr. M. Luckiesh reported that his experience in inspecting schoolrooms had convinced him that neither overhead lighting nor side-window lighting is satisfactory from the single standpoint of glare from glazed surfaces. Paper is never flat, and therefore, acting as a cylindrical mirror, it reflects a bright image of all light sources in many positions. He strongly advocated the simple remedy of removing all glazed surfaces from general use. Mr. Lancaster stated that all factors must be considered in schoolroom lighting and emphasized the adaptive power of the eye as a help in overcoming the non-uniformity of illumination from window lighting. Mr. Ward Harrison, Cleveland, Ohio, described an office lighted by means of diffused light from a saw-tooth roof, where the area of glass was 20 per cent of the total floor area. The artificial light sources were hung directly below the vertical glass, causing a distribution of artificial light quite similar to that of daylight. This was satisfactory and advisable. Dr. H. E. Ives called attention to the genius of the illuminating engineer in developing devices for special cases. Mr. Stickney spoke of the production of glare by adjacent buildings, and Dr. Miles Standish, of Boston, discussed the work of the schoolhouse board of that city. In closing Dr. Kerr called attention to the irritable effect of red light as compared with that of other colors.

In the absence of Mr. W. L. Coffee, his paper on "Rural School Illumination" was not presented.

Methods of Testing Illumination

Dr. George Fitz, Peconic, N. Y., next read his paper on "Practical Methods of Testing Light in Schoolrooms, with a Demonstration of the Photometer for Lighting Tests in Schoolrooms and Workrooms." His paper considered illumination from the standpoint of the teacher. He stated that a minimum of 1 ft.-candle was the least advisable on the darkest day. He thought visual acuity an incomplete test and he discussed some of Weber's famous work on sky area subtended by windows, afterward describing his own apparatus for roughly determining the sky area. The instrument consists of a spherical convex lens blackened inside and graduated by a simple means of calibration. The image of the window is seen in the mirror, and by means of the scale the sky area is roughly measured. Closing the discusssion, Dr. Kerr described a scale combined with a lens which measures the available sky area at any part of the room.

Both of the joint sessions were well attended, and the delegates evinced much interest in the proceedings.

Public Service Commission News

Massachusetts Commission

The Gas and Electric Light Commission has issued a fifty-two-page bulletin of legislation passed in the State in 1913 which is of special interest to gas and electric light companies and to municipalities owning lighting plants. In addition to the acts previously reviewed in these columns, the bulletin includes statutes bearing upon the sale of commodities by weight, special licenses of engineers and firemen, admission of accounts as evidence, interest on damages awarded for death caused by negligence, prohibition of making up time lost on legal holidays, workmen's compensation, legislative counsel, storage of explosives, approval of bills against municipalities, reports upon accidents, and the municipal financing of improvements.

West Virginia Commission

Hearings before the West Virginia Public Service Commission on the application of the West Virginia Hydro-Electric Company, which seeks authority to construct a power plant and dams on the Cheat River, were ended on Aug. 25. A formal session of the commission to consider the proposition will be held on Sept. 9 at Charleston, W. Va. The company is controlled by Pittsburgh capitalists. The Elkins Coal Company urges that the hydroelectric company be ordered to provide locks in its dams. The hydroelectric company offered, in case a railroad is built above the new high-water line after the dams are completed and costs more than one above the present high-water line would, to pay the difference in the cost of construction.

Indiana Commission

The Merchants' Heat & Light Company and the People's Light & Heat Company of Indianapolis have been merged in accordance with a decision of the Indiana Public Service Commission. The companies complied in all respects with the decision of the commission on the question. The franchises of both companies were surrendered and the Merchants' Heat & Light Company, as the consolidated corporation, will take out an indeterminate permit.

Wisconsin Commission

The Wisconsin Railroad Commission has ordered a slight reduction in the rates of the Milwaukee Gas Light Company. The rates ordered are as follows: First 7000 cu. ft. per month, 75 cents net per 1000 cu. ft.; next 13,000 cu. ft., 65 cents; next 80,000 cu. ft., 55 cents; next 100,000 cu. ft., 50 cents; all over 200,000 cu. ft., 45 cents. The old rates ranged from a charge of 75 cents net for the first 10,000 cu. ft. per month to a charge of 50 cents for all gas used in excess of 100,000 cu. ft. The present value of the property as determined by the commission is $8,770,148, and the cost of reproduction $9,841,986. No objection was made to the physical valuation but considerable testimony was introduced by witnesses for the company to prove that the commission's allowance of 15 per cent to cover engineering, superintendence, interest during construction, contingencies, etc., was too low. The opinion points out that many of the factors making up the somewhat larger allowances urged by the witnesses were taken into account in the unit prices used in the valuation.

No allowance was made for going value, although the defendant attempted to justify a claim of approximately $2,000,000. The commission concluded that from all available records it appeared that the earnings had been amply sufficient to provide a reasonable return on the investment and to take care of depreciation. Attention was called to the fact that, although the population of the city has increased by only 93 per cent since 1890, the number of consumers has increased 640 per cent, the gas sales 645 per cent and the sales per capita from 1900 cu. ft. in 1890 to 7300 cu. ft. in 1911. An allowance of from $500,000 to

$550,000, of which $350,000 represents the value of stores and supplies, was made for working capital. Depreciation was provided for at the rate of 2.5 per cent on the depreciable property.

The company contended that certain economies, particularly that effected through the introduction of the booster system, should be capitalized. While not accepting the claim in its entirety, the commission gave considerable weight to the matter of "economies resulting from unusual engineering foresight" in arriving at the value of $10,700,000, which was used as the basis of rates.

A study of the consumer data showed that under the present rates about 70 per cent of the consumers are not paying their just share and that this number use about one-third of the gas sold. The commission declared that it would be impossible to remedy this condition entirely without making the rates for the small consumer exorbitant, and consequently the schedule as ordered is designed to distribute the burden over all the consumers instead of over a small group.

In the matter of the application of the Citizens' Telephone Company of Eau Claire for authority to issue securities for the purpose of acquiring the property and permits of the Chippewa County Telephone Company, located in Eau Claire, and to extend the same and conduct a local exchange business, the commission has granted the request in so far as it applies to the acquisition of the property but has refused that portion of the request which relates to the extension of the business.

Current News Notes

CITIZENS' TERMINAL INVESTIGATION IN CHICAGO.—A group of public-spirited citizens in Chicago has secured pledges of $77,000 toward a fund of $100,000 to defray the expense of an expert and disinterested investigation of the railroad terminal problem in Chicago. Mr. Bion J. Arnold has been retained to make a general inquiry of a preliminary nature, for which $25,000 has been set aside.

* * *

EDISON SERVICE OUSTS ISOLATED PLANT IN BROOKLYN POST OFFICE.—The United States Treasury Department has just concluded a contract with the Edison Electric Illuminating Company of Brooklyn for the exclusive supply of electrical energy to the Brooklyn Post Office. The isolated plant supplanted by central-station service has been in operation for the past decade, and the equipment comprises one 75-kw and two 50-kw units directly connected to standard vertical automatic engines.

* * *

PREDICTS TALKS BY WIRELESS TELEPHONY.—Mr. Godfrey Isaacs, of the Marconi Wireless Telegraph Company, in a recent statement said that the day is not now far distant when passengers on ocean steamships will talk with those on land over a wireless telephone. He intimated that the Marconi company would be able to turn wireless telephony to practical commercial account at an early date, but until the company is prepared to show exactly what definite results can be obtained he will vouchsafe no further information.

* * *

INSTRUCTION IN UTILITY VALUATION.—The establishment of a chair in the University of Missouri for instruction on the subject of physical valuation and appraisement of public utilities of every character has been recommended by Mr. J. M. Atkinson, chairman of the Missouri Public Service Commission, to the curators of the university. Mr. Atkinson believes there should be such a course opened in connection with the economics and engineering department, the graduates from which would be eligible for employment by the Public Service Commission.

* * *

MASSACHUSETTS WATER-POWER INVESTIGATION.—The chairmen of the Massachusetts Gas and Electric Light Commission and of the Harbor and Land Commission and the Attorney-General of the State have been named by recent legislation as a special board to investigate the better conservation of waters and the utilization and equalization of stream flow within the commonwealth, with authority to hold public hearings and to employ such engineers and assistants as may be required. The board is to submit its report with recommendations for legislation to the next General Court not later than Jan. 14, 1914.

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GOVERNMENT CONSERVATION POLICY CRITICISED IN EPIGRAM.—Mr. W. P. Hepburn, for twenty-two years a representative in Congress from the State of Iowa, is still, at the age of eighty, keenly observant of public affairs. He delivered an address at the Keokuk-Hamilton water-power celebration in Keokuk, Ia., on Aug. 26. In the course of it he referred unfavorably to the modern governmental theories of the conservation of natural resources. Alluding particularly to forestry administration, he said: "In foreign countries, as in Great Britain and Germany, the forestry service plants trees; in this country we plant inspectors and rangers."

* * *

UNION ELECTRIC PICNIC IN ST. LOUIS.—The fourth annual field day and picnic of the Union Electric Light & Power Company Section of the National Electric Light Association in St. Louis was held in Ramona Park on Aug. 23 and was a great success. The number present was nearly 500, embracing employees and members of their families, and an interesting program of athletic contests and games was carried out. Prizes were awarded to the winners. Mr. F. D. Beardslee was grand marshal of the occasion. Messrs. H. W. Eales, H. W. Korhammer, John Fay, R. L. Beall and others were also active in seeing that everybody had a good time.

* * *

INTERURBAN ELECTRIC ROADS UNPROFITABLE.—According to President Mortimer of the Milwaukee (Wis.) Electric Railway & Power Company, interurban electric lines do not pay under present conditions. He maintains that few interurban electric railways have ever proved either paying or profitable investments. Such money as has been made out of them has come through the sale of the securities rather than from the operation of the utility. These facts, according to Mr. Mortimer, are getting to be very generally known by investors and those who have capital for the development of such enterprises, and it is becoming correspondingly hard to obtain money with which to carry on such work.

* * *

PACIFIC GAS & ELECTRIC COMPANY SEEKS TO AVOID GOVERNMENT RESTRAINTS.—The officers of the Pacific Gas & Electric Company, of San Francisco, Cal., have instituted a suit against Secretary of Agriculture David F. Houston and Mr. Henry S. Graves, chief of the Forest Service, to restrain the government from preventing improvements by the company on its property adjoining the Tahoe National Forest. The company seeks permission to build an aqueduct over a corner of the forest reserve and contends that the Tahoe Forest is a state property over which the federal government has no jurisdiction. It sets forth that its improvement work, including the raising and enlarging of the Lake Spaulding reservoir, is to cost approximately $5,000,000. The Forest Service objects to further elevation of the reservoir on the ground that the water will overflow parts of the Tahoe National Forest. It also opposes the construction of an aqueduct across the forest reserve.

X-Ray Cure for Cancer.—Roentgen rays filtered through silver, copper or tin plate are said to have been used by Dr. Roberts, senior surgeon of the General Hospital at Hobart, Tasmania, in the treatment of cancer. The surgeon states that he has successfully treated forty persons suffering from the disease.

* * *

Bibliography on Valuation of Public Utilities.—The August issue of the *Proceedings* of the American Society of Civil Engineers contains a bibliography on the valuation of public utilities. It was first prepared by the library force of the society on May 15, 1912, for the use of the special committee on valuation of public utilities and has been brought up to date.

* * *

Wireless Explosion Denied.—The *Eclair* of Paris in a long article argues that the ultra-violet rays with which Ulivi, an Italian inventor, asserted he was able to set off explosives by wireless at a great distance did not exist, and that such explosions as those which occurred in recent tests were merely accidental. Newspapers have recently printed long but vague accounts of Ulivi's success with what he calls "F" rays.

* * *

Government Wireless Station to Be Erected in Illinois.—At a recent conference between Mr. Josephus Daniels, the Secretary of the Navy, and Capt. George R. Clark, commandant of the United States naval training station at Great Lakes, Ill., it was decided that a high-power radio station and plant should be erected at the latter place. The Great Lakes station is near Lake Bluff, Ill., on the shore of Lake Michigan, and about 30 miles north of Chicago.

* * *

Push-Button Gas-Lighting Fixture.—An electric gas valve is combined with an ignition device in a new French gas-lighting attachment which can be screwed onto the jet beneath the burner. Pressing a button sends a current through the electromagnetic valves, opening it and admitting gas to the adjoining ignition chamber. Here the current has meanwhile heated to redness a coil of fine platinum wire, which by occlusion of hydrogen rises to a white heat, igniting the gas.

* * *

Abandoning Telegraph Lines in Africa.—Wireless telegraphy is interfering with the happiness of natives of Central Africa, for it has deprived them of an unfailing supply of wire to be worked up into ornaments and weapons. Some big mines operated by European capital in Central Africa have recently abandoned their wire-telegraph lines from railroads to the mines, and established communication by wireless. Maintenance of the wire lines has been difficult because of the demand for the wire by native belles, and also because of the occasional wanton destruction of pole lines.

* * *

Couldn't Stop Their Car.—A rather amusing but somewhat vexatious incident is reported as having happened at Huntington, Ind. A mother and her daughter found that they were unable to stop their electric car when they wanted to get out. Finally the vehicle was headed up a steep hill, the brakes applied and the speed reduced sufficiently so that the mother could jump out. The elder lady telephoned her husband and shortly afterward he jumped aboard the car when it was going up the same hill. Masculine ingenuity was also unable to check the mad career of the car, however, and it was driven up one street and down another for nearly four hours until the battery was exhausted. To culminate its mischief, the car "died" on the outskirts of the town, and the owner had to walk a considerable distance to his home.

SOCIETY MEETINGS

Jovian Activities Renewed.—The weekly luncheons of the New York Jovians were resumed on Sept. 3, when Mr. F. E. Watts, eleventh Jupiter of the order, spoke on the plans for the Jovian Congress to be held in New York on Oct. 14-16 inclusive. There are to be a number of rejuvenations and joviations on Jovian Day, Sept. 6, among them one in connection with the National Conservation Exposition.

* * *

Picnic of the Electric Club of Chicago.—The annual picnic of the Electric Club of Chicago was held at Northfield Grove, near Shermerville, Ill., on Aug. 21. About 200 ladies and gentlemen attended and indulged in athletic contests, dancing, guessing contests and other games. Prizes were awarded to the successful contestants, and, in spite of some railroad delays in reaching the grounds, the participants enjoyed themselves thoroughly.

* * *

Convention of the Electric Vehicle Association of America.—The fourth annual convention of the Electric Vehicle Association of America will be held in Chicago, Oct. 27 and 28. The convention program is now nearing completion, and the tentative arrangements indicate that papers of great interest not only to manufacturers and central-station companies but also to users and prospective users of electric vehicles will be presented.

* * *

Annual Meeting of Eastern New York Section, N. E. L. A.—The annual convention of the Eastern New York Section of the National Electric Light Association will be held at the Hotel Saginaw at Lake George, Sept. 15. The papers committee is preparing an elaborate program which will consist of a number of papers of interest to central-station people. Mr. Robert E. Russell, General Electric Company, Schenectady, N. Y., is secretary of the association.

* * *

Special Cars from Chicago to Pittsburgh Convention.—The Chicago Section of the Illuminating Engineering Society has selected the Lake Shore Railroad as the official route from Chicago to Pittsburgh on the occasion of the seventh annual convention of the society to be held in Pittsburgh on Sept. 22 to 26 inclusive. Special sleeping cars will be attached to the "Pittsburgh Limited," leaving the Lake Shore station in Chicago at 8:20 p.m. on Sept. 21 and arriving in Pittsburgh at 7:40 a.m. the next day. Stop-overs of ten days will be allowed at South Bend, Toledo, Sandusky, Cleveland and Youngstown. The stop-over at Cleveland will afford visitors an opportunity to inspect the engineering laboratory of the National Electric Lamp Association. Mr. J. B. Jackson, 28 North Market Street, is secretary of the Chicago Section.

* * *

Jovian Club Established in Montreal.—A Jovian Club has been opened at Cooper's Restaurant, Montreal, Que. The executive committee is composed of Messrs. W. B. Shaw, president of the Montreal Electric Company, representing electrical contractors; W. J. Doherty, sales manager of the Northern Electric & Manufacturing Company, representing supply houses; R. M. Hannaford, engineering department of the Montreal Tramways Company, representing the traction interests; C. E. Duncan, representing the manufacturing interests; C. M. Tate, chief inspector electrical department Canadian Fire Underwriters' Association, representing inspection interests; W. H. Winter, plant superintendent of the Bell Telephone Company, representing telephone interests, and P. T. Davies, of the Montreal Light, Heat & Power Company, representing the central stations. Mr. James Bennett, president of the club, and Mr. D. H. Ross, vice-president, are also on the committee.

Intensified Lighting of Business Thoroughfares

Luminous-arc installations in Boston, Cambridge and Lynn, Mass.—Data on illumination and arrangement of units—Merchants' associations instrumental in movements for more light

THE luminous-arc lamp with ornamental standard is rapidly taking its place in the field of downtown street lighting. Being a single unit of high intensity with a light distribution curve suited to the needs of business thoroughfares, it is favorably regarded by merchants, although in intensity of illumination and quality of light it contrasts greatly with the tungsten cluster, its greatest competitor in this class of work. A number of installations of ornamental luminous arcs have been made recently in and near Boston which are typical in a way of many others that have been made and are being made in various parts of the country. The chief features of some of these systems are outlined below.

Ornamental Lighting in Boston Back Bay

An ornamental luminous-arc system was inaugurated on Aug. 1 on Huntington Avenue, Boston, one of the widest and most important thoroughfares in the Back Bay district. The section of the avenue equipped is about 3000 ft. long, extending between Copley Square and Massachusetts Avenue and offering unusually favorable conditions for effective display lighting. The installation is the first permanent one of its kind in Boston and was designed to stimulate the growth of lower Huntington Avenue along lines of modern business enterprise, paralleling the extensive development of mercantile interests along Boylston Street. The installation is the outcome of vigorous work by the Huntington Avenue Improvement Association, an organization of merchants and property owners interested in the proper development of this street, which is rapidly passing from a residential to a business avenue of traffic.

Fig. 3 is a view of the avenue looking west from Irvington Street and showing the previous illumination of the thoroughfare by 6.6-amp series direct-current magnetite-arc lamps. There were fourteen of these installed in the section under consideration, the lamps being supported on wooden poles 250 ft. apart as a rule and occupying locations in the center of a double-tracked reservation used by the Boston Elevated Railway Company. This installation gave excellent lighting for residential purposes but an insufficient illumination for commercial needs. As a result of the efforts of the improvement association, the city of Boston increased the number of municipal arc lamps to eighteen, and these were changed to the luminous 6.6-amp type, mounted on 18-ft. Lundin ornamental poles and relocated on the curb, the lamps being operated all night on the regular city schedule. To provide additional lighting, twenty-three more lamps of the same kind have been installed on poles on the curbs, and spaced as evenly as possible with the municipal lamps. The twenty-three lamps were supplied at the expense of abutters, the cost being about $200 per lamp, and these form a "private property" system which is operated from dusk until midnight daily, energy being supplied from the Scotia Street substation of the Boston Edison company, from which point the installation is controlled. Fig. 1 shows substantially the same section of the street as Fig. 3, but viewing it in the opposite direction, east from Falmouth Street. Huntington Avenue is about 100 ft. wide from curb to curb, with broad sidewalks and a central reservation about 15 ft. in width, as noted.

The diagram printed as Fig. 6 shows the intensity of illumination on the center line of the reservation both before and after midnight, and on the center lines of the south and

FIG. 1—ILLUMINATION OF HUNTINGTON AVENUE, BOSTON, MASS., WITH 6.6-AMP ORNAMENTAL LUMINOUS-ARC LAMPS

north sides of the avenue, the readings being taken with a Sharp-Millar photometer on a plane 3 ft. above the ground. The illumination on the center lines of the north and south roadways is on the whole remarkably even, often varying from side to side at the points taken by less than from 0.05 to 0.1 ft.-candle. It is of interest to note that

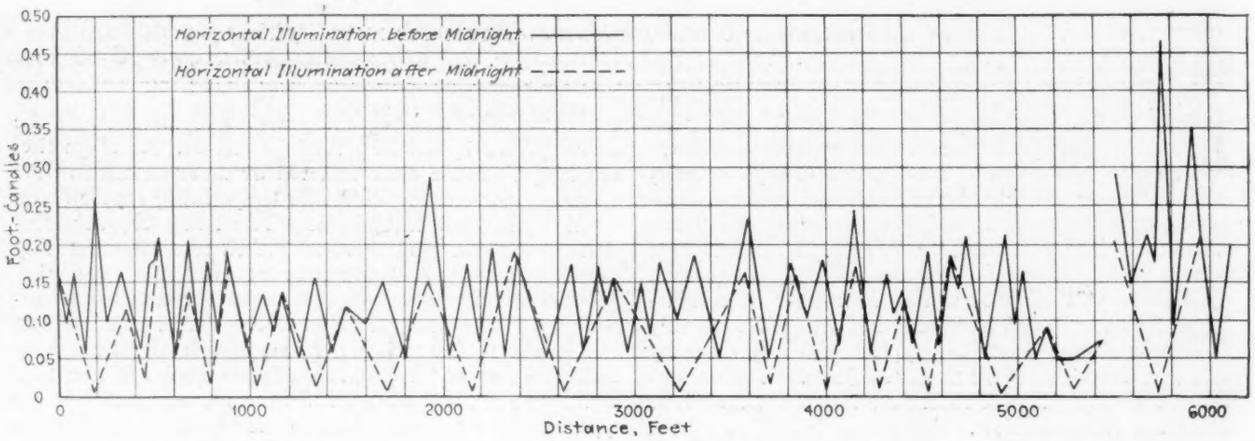


FIG. 2—CURVES SHOWING HORIZONTAL ILLUMINATION BEFORE AND AFTER MIDNIGHT AT CAMBRIDGE

in the reservation, which is used exclusively by street cars, the range of illumination with all lamps in service is from about 0.3 ft.-candle to 0.5 ft.-candle, while the range in the center of each roadway is from 1.5 ft.-candles maximum to about 0.1 ft.-candle. The location of the lamps on the opposite curbs in a street of this character, which in the Boston instance is treeless, provides illumination exactly where it is most needed, and even at the crossing breaks in the grassed reservation the illumination on the pavement is sufficient to make it easy for pedestrians or vehicle passengers to cross the car tracks without difficulty. The headlamps of the cars provide for the longitudinal illumination of the reservation and at great economy, since each car carries its own specialized and intensified directional lighting at its front, thus making it unnecessary for either the city or the improvement association to meet the special requirements of powerful reservation lighting in the direction of traffic movement. The total fund raised by the Huntington Avenue Improvement Association was about $6,500, of which about $81 per lamp of the private property system was set aside to meet the first year's cost of service.

Performance of Lamps at Cambridge

In connection with the installation of fifty-five ornamental luminous-arc lamps of the 6.6-amp size on Massachusetts Avenue, North Cambridge, Mass., a test has recently been made by the engineers who furnished the equipment to the Cambridge Electric Light Company, on whose system the lamps are located. The arrangement of lamps is somewhat different from the usual installation of this kind, on account of local geographical conditions. Massachusetts Avenue in this part of Cambridge combines residential and business functions, besides varying considerably in width throughout the section equipped, which is some 6000 ft. long. The arcs are each 14.5 ft. above the sidewalk, and medium alabaster globes are used. The avenue is about 70 ft. wide for the first mile of the installation, starting from a point 350 ft. north of North Cambridge Junction. At Porter Square the width increases, narrowing again to 63 ft. for the remainder of the way. In general the lamps are somewhat staggered, although the distances apart vary greatly. For a distance of about 540 ft. in North Cambridge, between stations 350 and 890 on the accompanying diagram of illumination throughout the route, the

FIG. 3—PREVIOUS INSTALLATION OF ARC LAMPS ON HUNTINGTON AVENUE, BOSTON

lamps are all on one side of the avenue on account of local conditions. Shade trees are found on a large part of the route.

The horizontal illumination down the center line of the avenue opposite and half way between each lamp was taken with a Sharp-Millar photometer at a height of 3 ft. above the ground, the result being shown on the diagram (Fig. 2). The full-line curve shows the illumination before midnight, the dotted line that after midnight. At midnight the lamps on the east side of the avenue are all cut out of service, and approximately every other one on the opposite side, making an average spacing of about 300 ft. At other times the average spacing is 115 ft. Two of the lamps are located on North Beacon Street, and after midnight one of these and thirty-three lamps on the avenue are out of service. The average horizontal illumination is 0.136 ft.-candle before midnight and 0.086 ft.-candle after midnight. Reference to the diagram (Fig. 2) shows several high values. That at station 1940 is due to the fact that two lamps are placed only 26 ft. apart, the reading being half way between the lamps only and not opposite. At station 3600 two lamps were only 30 ft. apart and at station 4150 only 24 ft. apart.

FIGS. 4 AND 5—LIGHTING ON MASSACHUSETTS AVENUE, CAMBRIDGE, LOOKING TOWARD PORTER SQUARE BEFORE AND AFTER MIDNIGHT

The break in the curve at station 5425 is due to a railroad bridge with solid plate girders, making it impossible to read the photometer at a height of 3 ft. above the highway. On account of the extreme width of the avenue, 70 ft., the readings opposite the lamps, taken after midnight, agree very closely with those taken earlier, whereas the half-way readings are much lower, being about 0.005 ft.-candle.

In this installation the company was obliged to supply energy to the ornamental lamps from overhead circuits, for the reason that the underground service could not be

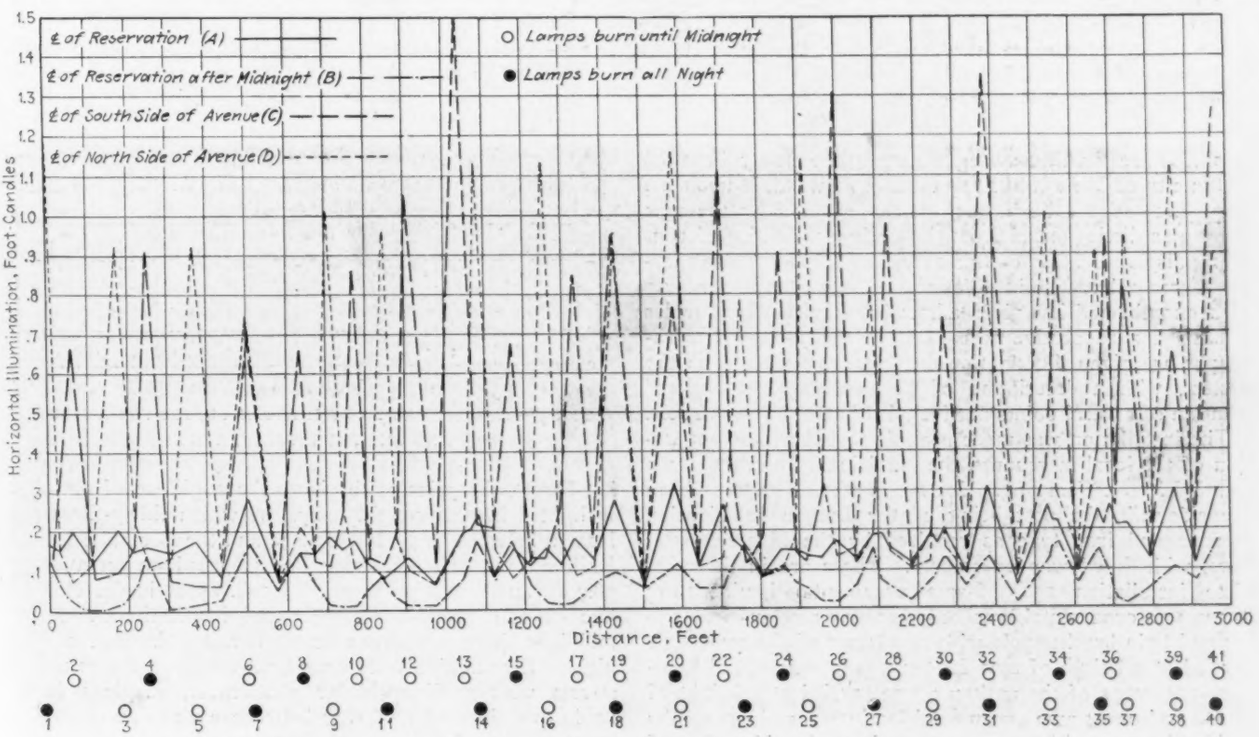

℄ of Reservation (A)
℄ of Reservation after Midnight (B)
℄ of South Side of Avenue (C)
℄ of North Side of Avenue (D)
Lamps burn until Midnight
Lamps burn all Night
Horizontal Illumination, Foot Candles
Distance, Feet
0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000
2 4 6 8 10 12 13 15 17 19 20 22 24 26 28 30 32 34 36 39 41
1 3 5 7 9 11 14 16 18 21 23 25 27 29 31 33 35 37 38 40

FIG. 6—CURVES SHOWING INTENSITY OF ILLUMINATION ON HUNTINGTON AVENUE, BOSTON

completed in time for the opening of the display lighting. Contrary to the general impression, it has been found that the use of wires running from cross-arms overhead to the ornamental posts below is not materially objectionable. The wires are brought into the post interiors through holes bored in the upper part of the post and fitted with porcelain bushings. They are run down the inside of each post to a standard Lundin cut-out in the lower portion, and thence back to the arc lamp at the top. Upon casual inspection, the wires are scarcely noticeable, even when they have been carried from the top of a pole on one side of the street across to the ornamental post on the other side.

Results at Lynn

In the *Electrical World* of Jan. 11, 1913, page 101, there was printed an illustrated description of the ornamental luminous-arc lighting system at that time newly installed in the city of Lynn, Mass., and emphasis was laid upon the large area of the downtown district covered by the new service as distinguished from the ordinary practice of confining display lighting of this character to one or two thoroughfares only. The installation has now been in use over eight months and has given admirable service. It provides a basis for suggestive tests, and in the following paragraphs are given illumination data recently secured on the system, with a description of its essential features and mention of several points not included in the former article.

DATA ON LYNN (MASS.) ORNAMENTAL LUMINOUS-ARC LAMPS

	Number of Lamps	Length of Street	Average Width of Street	Average Spacing in Feet	Total Watts	Watts per Square Foot	Watts per Front Foot	Maximum Horizontal Illumination, Ft.-Candles	Minimum Horizontal Illumination, Ft.-Candles	Average Horizontal Illumination, Ft.-Candles
Andrew Street	9	576	34	60.7	4,788	0.24	4.16	1.110	0.260	0.73
Munroe Street	14	828	32	60.1	7,448	0.28	4.50	1.000	0.275	0.68
Oxford Street	11	665	36	55.1	5,852	0.24	4.40	0.990	0.290	0.62
Market Street before midnight	38	1686	60	45.2	20,216	0.20	5.60	0.751	0.113	0.42
Market Street after midnight	7	1686	60	278.7	3,724	0.037	1.10	0.459	0.0125	0.13
Market Street from City Hall Square to railroad viaduct	33	1260	57	38.9	17,556	0.24	6.97	0.751	0.115	0.47
Market Street from railroad viaduct to Broad Street	5	426	72	67.0	2,660	0.087	3.12	0.196	0.113	0.15

The installation was made possible through the co-operation of the local merchants, the municipality and the Lynn Gas & Electric Company. The arc is carried 14.5 ft. above the sidewalk, the post being of the Lundin combination wooden and iron type as required by the Massachusetts laws, with fluted wooden column. There are in the complete installation 150 6.6-amp ornamental luminous-arc lamps, two ornamental bracket lamps, one combination trolley and twin bracket pole with two lamps of the same type carried at a height of 27.5 ft., ten 4-amp ornamental luminous-arc lamps of the parkway type carried at a height of 18 ft., and one 4-amp ornamental luminous-arc lamp of the residential type with the arc 12 ft. above the sidewalk. Of these, thirty-five 6.6-amp lamps and all of the 4-amp lamps burn all night. The cost to the city is $8,260 for the 6.6-amp lamps burned until midnight and $2,884 for those burning all night, the parkway lamp service costing $906.40 a year, making a total cost for the entire service of $12,050.40 for the year. The standard pole is mounted on a concrete foundation 2 ft. square at the top, 3 ft. square at the bottom and 3 ft. deep, and each pole is provided with an absolute cut-out for lamp disconnection. At present there are 165 lamps in actual service, all being operated from mercury-arc rectifiers. The city of Lynn pays for the maintenance of the lamps, the prices being $70 per lamp a year for service until midnight and $82.40 for all-night service.

The cost of installation per pole was as follows:

Pole, including wiring and cut-out	$36.00
Twin cable wiring and absolute cut-out	6.40
Casing to cover lamp mechanism	4.00
Excavation and forms for concrete	2.00
Concrete foundation	7.00
Replacing broken sidewalks of concrete	2.00
Painting	1.14
Teaming	0.50
Foundation bolts	0.40
Protective casings on pole	1.64
Total cost of pole	$61.08

In the previous installation the district was lighted by 45 4-amp pendent-type luminous-arc lamps burning all night at a yearly cost of $82.40 per lamp, and these were removed in making the "white way" installation, the city being credited with $3,708, making the actual increased cost to the city for each year $8,342.40. Work is under way at present for the location of lamps on Ocean and Nahant Streets, the 4-amp residential type being used.

The cross streets in the district are well provided for in the way of ornamental lighting, Munroe, Oxford and Andrew Streets being active business thoroughfares as well as Central Avenue and Market Street. In general the lamps are staggered both on main and cross streets. The quantity and quality of light on the streets is at present probably unequaled, and notwithstanding the great amount of light coming from sources only 14.5 ft. from the ground, there is no glare and persons and objects can readily be distinguished from one end of the street to the other. Market Street, the principal business thoroughfare of the city, is lighted by thirty-eight lamps, of which thirty-three are located between City Hall Square and the Boston & Maine Railroad viaduct, the lamps being spaced on an average 38.9 ft. apart, though they are 67 ft. apart in the case of five lamps between the viaduct and Broad Street. After midnight there are seven lamps burning the rest of the night. Illumination tests have been made on the principal streets with a Sharp-Millar photometer, readings being made opposite and half way between each lamp down the center line of the street. On Market Street readings were also made after midnight, when all but seven of the lamps had been cut off. Readings were also made on Munroe, Oxford and Andrew Streets, and the results are shown in the accompanying diagram for the two last-named thoroughfares. The accompanying table gives the dimensions, number of lamps, spacing of lamps, energy consumption and illumination data for Andrew, Monroe, Oxford and Market Streets.

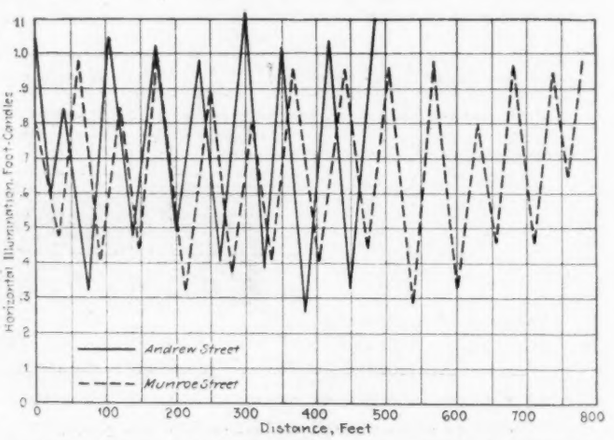


FIG. 7—HORIZONTAL ILLUMINATION CURVES FOR ANDREW AND MONROE STREETS, LYNN

Central-Station Developments at Hartford

Electric-truck battery interchange system on mileage basis—Codification of electric rate schedules —Development of industrial electric heating

AMONG significant recent developments in central-station service on the system of the Hartford (Conn.) Electric Light Company, the inauguration of a battery interchange plan with respect to electric-truck operation marks an important movement in the administration of this organization, always noted for its pioneer work in the field of popularization of electrical applications. The company is probably the first in the country to take up the work of stimulating the growth of electric-truck service by taking entire care of the problem of battery supply, from both the investment and maintenance points of view. The interchange system has been in use in Hartford for about a year and is meeting with the cordial co-operation of local business establishments besides furnishing a most desirable load for the generating stations and diversifying the company's output along attractive lines. Nothing like a final development has, of course, been attained as yet, but much has been learned about the practical application of an interchange system under the jurisdiction of a central station, and the company's practice is falling into well-standardized lines as each month passes.

FIG. 1—TRUCKS OF BOSTON BRANCH GROCERY USING SERVICE OF HARTFORD (CONN.) ELECTRIC LIGHT COMPANY

BATTERY INTERCHANGE SYSTEM

In establishing the system it was necessary to specialize at the outset on a single make of truck and a single form of battery. Arrangements were accordingly made with the General Vehicle Company and the Edison Storage Battery Company whereby the Hartford company acts at present as the local agent of each. The interchange system, or "Edison battery service system," as it is called by the company, was worked out on this basis, with the fundamental object of reducing truck operation to its simplest form. Under this system the Hartford Electric Light Company buys, maintains, charges and installs in the customer's truck all batteries necessary for its continuous operation, the price of the service being graduated upon a mileage basis according to the size of the truck, with a corresponding fixed monthly charge also dependent upon the capacity of the vehicle in service. By the company's plan the truck owner obtains a substantial reduction in his investment. No charging apparatus or private garage is necessary; the entire relief is secured from the care of batteries by employees of the truck owner; the cost is not increased by poor roads or busy seasons, and battery repairs and electric charging bills are unknown to the possessor of the vehicle. The customer exchanges batteries at a service depot owned by the company on State Street, in the heart of the business district. The facilities for interchange enable a battery to be taken out and another substituted in a very short time, from three to five minutes being enough.

The schedule of prices for service where the Hartford company furnishes the battery interchange and where all the charging is done at the central-station's depot is shown in the table on page 475.

EQUIPMENT OF BATTERY DEPOT

The battery depot of the company occupies an unused boiler room and, although somewhat temporary in its arrangement, is equipped with a hydraulic lift set into the floor for raising and lowering batteries between truck frames and a Cowan 2-ton portable hand truck. The wall panels are equipped in each case with fuses, ammeters, Sangamon ampere-hour meters, circuit-breakers and rheostats. Each panel provides for two charging circuits, and fourteen of the latter are at present in service. The circuit-breakers are provided with trip coils electrically operated by the pointers of the ampere-hour meters as they reach the zero indication upon the batteries' attaining full charge. The batteries are supported on 4-in. by 7½-in. timbers when being charged, and the hand truck is designed to permit raising any battery by manipulation of the handle. The hydraulic elevator in the floor is 70 in. long by 36 in. wide and is set between guide timbers in which the trucks are run to get an accurate line-up for changing batteries. Four hydraulic jacks, each 6 in. in diameter with a 14-in. lift, are provided, with attachments at the corners of the lift platform, and these jacks are controlled by a master valve which raises the platform uniformly in height. In case all the cradle hooks do not release quickly, one of four multiple valves will permit the raising or lowering of a corresponding corner of the platform independently of the others. These control valves are mounted on the wall out of the way of entering and departing vehicles. City water pressure of about 100 lb. per sq. in. is used in their operation.

CONTRACTS FOR SERVICE

The contracts covering this service are in card form, 5¾ in. by 7 in. in size, with tables to permit quick use in the file, and set forth the agreement of the company to provide battery equipment and service, the responsibility of the customer for the purchase of the truck without the battery, operation of the vehicle in and out of the central charging and exchange station, and the use of the odometer as the basis of billing. The company furnishes and installs an odometer for each vehicle, maintains the instrument, and checks its accuracy by request of the consumer. In case an odometer does not register, the mileage is esti-

mated from previous records on the same vehicle until the instrument can be replaced and repaired, the latter being done at the earliest possible moment. The customer assumes no responsibility as to batteries and odometers, except as they may be damaged by accident or fire when not under the control of the central-station company. The vehicle owner assumes the responsibility for the truck with regard to fire or accident. A regular inspection, not oftener than twice a month, is made by the central station upon the truck without extra charge. When exchanging a discharged for a charged battery the central station furnishes the driver with a coupon giving the miles which the charge should propel the truck, and if this mileage is exceeded, a towing-in charge is made by the Hartford company for bringing back cars stalled by reason of exceeding such mileage.

Every General Vehicle car in Hartford is now using this service, and at this writing the company is handling or has on order forty-three Edison battery service trucks. Prior to the adoption of the system at Hartford only seven trucks were sold in the city in twenty months, while in the seven months following the middle of February, 1912, when the company's plans became known, fifteen trucks were

FIG. 2—ELECTRIC JAPANNING OVENS, GRAY TELEPHONE PAY STATION COMPANY, HARTFORD, CONN.

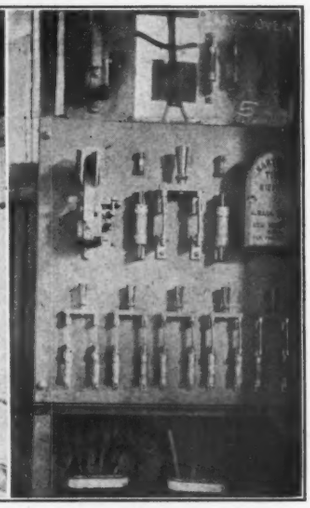


FIG. 3—SWITCHBOARD CONTROLLING JAPANNING OVENS, GRAY TELEPHONE PAY STATION COMPANY, HARTFORD, CONN.

purchased in the company's territory. The sliding scale of rates per mile promotes satisfaction to both the central station and the consumer, because any reduction in the rate which the consumer enjoys produces long-hour use of the truck per day, which is what the central station desires. Eighty-two per cent of the present users of the Edison battery service system operated gasoline trucks and delivery wagons prior to the adoption of electricity.

Among the records kept at the central battery station are a daily report of battery charges in vehicles, with battery and car numbers, odometer readings and mileage data, with the charging rate of batteries. A daily battery exchange record is kept, showing the car number, odometer reading, battery number, mileage and charging data for each battery put in and taken out of a truck. A monthly operating record is kept, in which the detailed handling of each battery on each day is tabulated with full particulars of charging rates, energy input, mileage and unit ampere-hour demands, labor, material and power costs. Another similar record carried through on a monthly tabulation gives the mileage, charging and trouble record of each vehicle by days, with a space on the reverse side for inspection entries.

Results Obtained in Practice

Among the users of this service are the firm of Downing & Perkins, teamsters, freight handlers and transfer men. In a recent interview a member of this firm stated that as compared with the capactiy of a 1-ton team, with a single horse, the 1-ton electric truck shows an efficiency of three to one. He pointed out that the peace of mind resulting from the use of a truck in place of horse traction is worth about half the initial cost of the vehicle, and emphasizes the capabilities of the electric vehicle in turning otherwise unprofitable orders into desirable ones through the saving in time of delivery effected. This firm is one of the best authorities on horse service in Hartford and has found that the use of a 1-ton electric truck since last August enables one spare horse to be eliminated, besides increasing the efficiency of the remaining horses in the establishment, since these now get the shorter hauls and the lighter loads in express service, which are most favorable to the best usage of the remaining equipment in the establishment. The truck has frequently performed work in two or three hours which would require all day with horse traction. The estimated yearly cost of operation of this truck, based upon the owner's experience, is as follows, the first cost of the car being $2,025:

Interest at 5 per cent	$101.00
Depreciation at 10 per cent	202.50
Maintenance at 10 per cent	202.50
Tires, 10,000 miles yearly	175.00
Liability insurance	110.00
Taxes at 2 per cent	40.50
Garage charges	120.00
Edison battery service of Hartford Electric Light Company	252.00
Drivers' wages	700.00
Total	$1,903.75

This shows a daily cost of $6.34 based on 300 working days per year. The truck averages daily earnings of $10.50, showing a margin of over $4 per day. The truck will pay for itself at this rate inside of two years. During the Christmas season the truck was used all day in the regular freight business of the firm and at night was utilized in collecting mail from street boxes, simply by the substitution of a second battery at the battery station on State Street. A record of 66 miles in a single day was made by the truck, despite the snowy weather then prevailing.

The department store of Wise, Smith & Company operates four trucks of from 750-lb. to 2000-lb. capacity in its delivery service. The 750-lb. wagon recently ran 536 miles in one week, displacing six horses in this work and taking the place of two regular routes and one special delivery route. The 2000-lb. wagon makes 30 miles a day in furniture delivery. Other large users are the Boston Branch Grocery, the Eagle Dye Works, the Sage & Allen department store and the grocery house of Tucker & Goodwin. In five months' operation the Eagle Dye Works averaged 45 miles per working day per car. The total number of electric commercial cars in service in the company's territory is now 45, and of electric pleasure cars, 300.

Codification of Electric Rates

The codification of the company's rates became effective on Dec. 1 last and is of particular interest on account of the encouragement which the various prices give to the cultivation of desirable classes of service. The rates automatically give the customer the benefit of long-hour use of energy and present graduated scales for wholesale service for lamps and motors, with reductions for succeeding blocks of energy, together with substantial decreases for long-hour lighting. The maximum rate is 9 cents per kw-hr.

Energy for residence lighting is offered on a meter rate of 9 cents per kw-hr., less 5 per cent discount for payment within ten days, or, upon the option of the customer, upon a flat-rate contract of one year's minimum service for low-voltage tungsten lighting. The flat-rate schedule is

$1 per month for ten 10-cp lamps, each additional 10-cp lamp being billed at 6 cents per month, or $1.50 per month for ten 20-cp lamps, with a charge of 12 cents per month for each additional 20-cp unit. In each case a 5 per cent discount for prompt payment is in force. The low-voltage lamps are supplied at about 58 volts, and the company had 82,816 low-voltage lamps on its circuits on March 1 last.

The wholesale lighting rates at Hartford are 9 cents per kw-hr. for the first 500 units, 7 cents for any part of the next 1000 kw-hr., 4 cents for the next 2500, 3.5 cents for the next 6000, and 2.5 cents for all energy in excess of the above. Under this contract discounts are allowed varying from 35 per cent for over 350 hours' use of the installed load per month to 2 per cent for over 100 hours' use, with a further 5 per cent discount for punctual payment. This rate enables the customer to increase his consumption substantially through long-hour usage, as illustrated by the following typical bills: The net bill of a customer, including the 5 per cent discount, for 10 kw of lamps installed and a meter reading of 1200 kw-hr. amounts to $84.60, or 7.05

SCHEDULE OF PRICES FOR BATTERY INTERCHANGE SYSTEM

Truck Capacity	Fixed Charge, Monthly	Rates per Mile in Cents				
		0–500	Next 250	Next 250	Excess of 750 Miles	Excess of 1000 Miles
750-lb.	$15	2½	2½	2	.....	1½
½-ton	20	3	2½	2½	.....	2
1-ton	30	3½	3	2½	.....	2
2-ton	40	4½	4	3½	.....	3
3½-ton	50	6	5	.....	3	.....
5-ton	60	7	6	.....	4	.....

cents per kw-hr. If he were to use 2400 kw-hr. or twice as much energy with the same installation, the net bill would be $107.40, or at a rate of 4.47 cents per kw-hr.

The rates for motor service are 4.5 cents per kw-hr. for the first 500 units used, with discounts down to a minimum of 1.3 cents per kw-hr. for all energy used in excess of 70,000 kw-hr. Energy used directly or indirectly for lighting is metered separately, but when in any month the energy

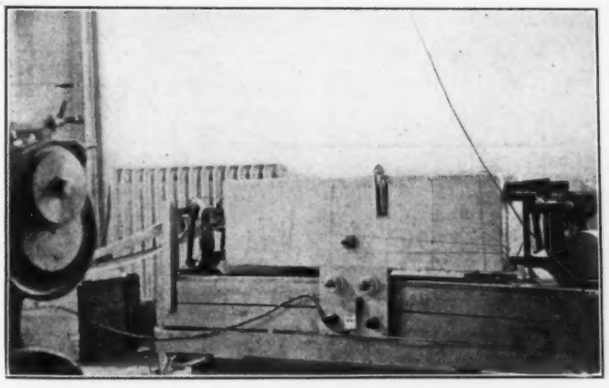


FIG. 4—ELECTRIC EMBOSSING MACHINE, CAMEO EMBOSSING & PRINTING COMPANY, HARTFORD, CONN.

used for motors exceeds 90 per cent of the total, the amount of energy used for lighting is included with that for motors and the total is billed at motor-service rates. In order to encourage the use of energy at night, any customer contracting for energy upon either the motor or the cooking schedule, upon a guarantee of a minimum payment of $20 per month for his night service, is allowed a discount of 40 per cent on such fraction of his total energy as is used between 10 p. m. and 7 a. m. The company installs special meters for recording this energy without extra charge, provided the demand for night motor service amounts to at least 10 per cent of the total. The night meter on the motor load is automatically cut in and out of circuit by a thirty-day clock movement controlling a switch in series with the meter potential coil.

Low Rates for Electric Heating Service

The company furnishes energy for operating electric heating and cooking apparatus upon a contract rate of 3

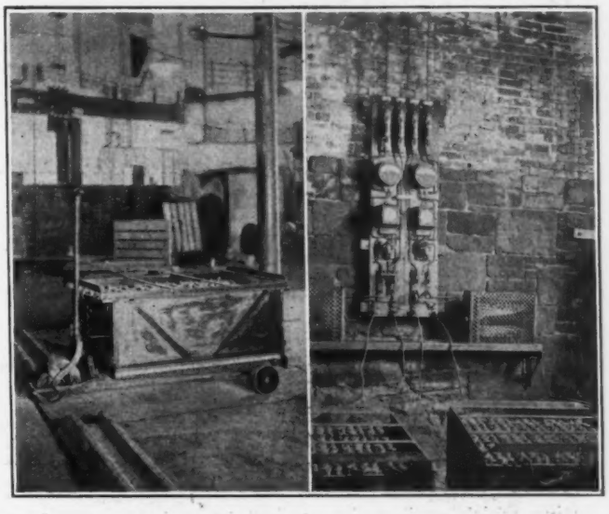


FIG. 5—BATTERY ON TRUCK, HARTFORD ELECTRIC LIGHT COMPANY'S STATION

FIG. 6—CHARGING PANEL, HARTFORD BATTERY SERVICE STATION

cents per kw-hr., on a guaranteed minimum payment of $1 per month. This schedule is applicable to residences, to include such other household appliances as flatirons, cleaners, etc., as may be desired in addition to the cooking apparatus under the contract rate.

Special attention is being given by the company to industrial electric-heating service, and extensive experiments are being conducted in this field in its private laboratory to determine the energy consumption and most economical methods of handling equipment under commercial conditions. The work along the lines of fireless-cooker or storage-stove service previously outlined in this journal is being continued commercially, and it is hoped to present the results at a later time. Among the representative industrial electric-heating installations on the system, that of the Gray Telephone Pay Station Company is of much interest. In the japanning department of this concern are now five electric ovens occupying a space 26 ft. long, 6 ft. wide and 7 ft. high, each having adjustable shelves and being operated between the hours of 10 p. m. and 6 a. m. on the night-power schedule. The total connected load of these ovens is 43.5 kw, the sizes ranging from 4 kw to 21 kw. All are supplied with single-phase current at 220 volts and are run at an interior temperature of about 300 deg. Fahr. The ovens are provided with from one to two 5-in. vent outlets discharging into a 14-in. trunk duct carried above the battery, but in a new installation to be made in the near future, in a new building to be occupied by the concern, it is planned to run the ovens only an hour on the vent piping when starting up, the outlets then being cut off through the operation of a time switch. It is found that with electric heating no danger of fire exists, whereas with the use of gas in this field serious results are liable to occur at any time.

The ovens are each controlled by a switch and circuit-breaker mounted upon a small switchboard in the japanning department, and an electric time switch is installed on this board to close and open the breakers at the designated hours. It is found that a better finish is given the product

of this house by the use of electric heating. All the ovens are operated on a single heat. Similar ovens are being installed for the New Departure and John Pratt companies.

Two other installations are those of the Cameo Embossing & Printing Company and the Smith-Worthington Company. The former concern has developed a machine with a connected load of about 1 kw, by which a special type

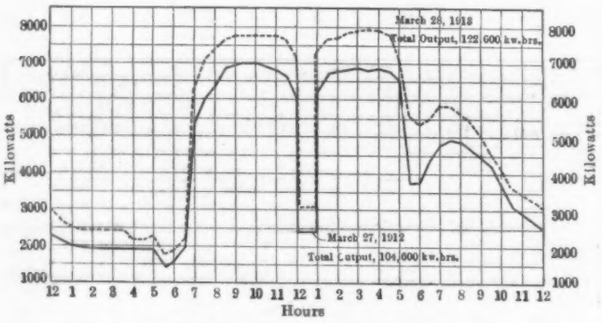


FIG. 7—LOAD CURVES OF HOUR-TO-HOUR OUTPUT

of raised printing or embossing is accomplished on cards and high-grade paper, in place of the former method of die engraving. Energy is supplied on a day-load basis, and the machine can be operated either at 2000 deg. or 500 deg. Fahr., being driven by a ⅛-hp direct-connected motor. General Electric "P" tubes are used as the heating element and the heat is applied to the ink at a stage in the process of printing which enables the product to be turned out at a much reduced cost in comparison with die engraving. In the plant of the Smith-Worthington Company, maker of saddlery, electricity is used in heating the wax thread on stitching machines. The work was formerly done by steam at 40 lb. pressure distributed through ⅛-in. copper tubing.

Tungsten Lamp Renewal Policy

Besides renewing all carbon standard and graphitized-filament lamps free, the company now offers free renewals of 500, 400, 250, 100 and 60-watt tungsten lamps with either clear or frosted globes, provided a burned-out lamp is returned with unbroken glass, and it also renews 40-watt and 25-watt lamps at 15 cents and 30 cents each respectively. In making this offer the company at present restricts it to one renewal per socket per year, in order to prevent the use of such lamps in locations subject to excessive breakage. Renewals of low-voltage tungsten lamps are furnished at 10 cents each, provided burned-out lamps are returned with glass unbroken.

Growth of Business

The accompanying load curves of the company's hour-to-hour output on March 27, 1912, and March 28, 1913, furnish a suggestive comparison of the lines of development in the utilization of electricity in its territory. The total output in the 1912 day was 104,600 kw-hr. and the maximum load 7000 kw, giving a load-factor for the day of about 61 per cent. For the 1913 date the total output was 122,600 kw-hr., a gain of over 17 per cent, and the maximum load was 7900 kw, giving a load-factor of 64.5 per cent. There was a gain in the forenoon and afternoon day loads of about 1000 kw, and the noon valley was filled to the extent of an output about 700 kw greater in the present year. A significant increase in output is that between midnight and 5 a. m., about 400 kw having been added to the demands upon the system in the ordinarily low-load period of the early morning hours. This increase is in part due to the extension of the company's industrial heating and electric-vehicle battery-charging service. It is noteworthy that the evening lighting peaks in both years were far below the day-load maxima.

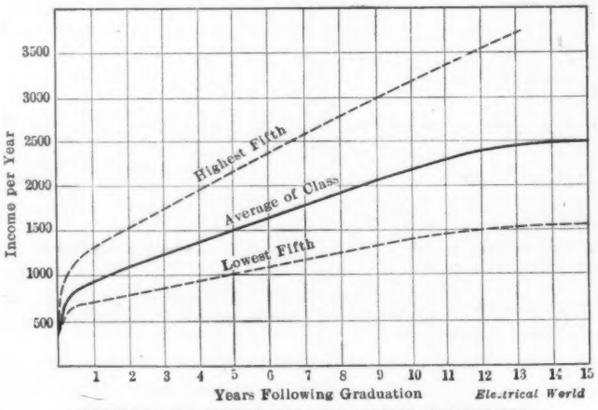
The growth of the company's business has necessitated its temporary removal from its former offices, where a new five-story stone and brick building will shortly be erected for its use. The new building will cost over $200,000 and will have a frontage of 130 ft. and a depth of 100 ft. The present offices are on the opposite side of the street, and the appliance exchange of the company is on Asylum Street, a neighboring thoroughfare. The new building will house all the executive and business departments, with ample space for the exhibition and sale of appliances. In closing, data bearing upon the company's growth are suggestive. The gross receipts have increased from $345,705 in 1901 to $1,025,918 in 1912; the present per capita earnings of the system are approximately $9; the maximum net rate has been reduced from 20 cents per kw-hr. in 1901 to 9 cents at present, and the income from residential lighting has risen from $23,437 in 1901 to $187,413 in 1912. In the last three years the lighting income (residential) has practically doubled, mainly through the introduction of flat-rate, low-voltage service. The sales of energy for motor service have increased from $81,340 in 1901 to $337,345, or $2.94 per capita, in 1912, and the total output of the generating stations has risen from 8,616,000 kw-hr. in 1901 to 36,897,000 kw-hr. in 1912. The latter output, of approximately 322 kw-hr. per capita per year, is one of the record productions of individual American central stations. The total connected motor load as of March 1 was 16,804 hp.

Incomes of Electrical Graduates

The School of Science and Technology, Pratt Institute, Brooklyn, N. Y., has just completed a detailed investigation into the incomes earned by its alumni, the results of which as concerns the graduates of its electrical department are presented in the accompanying curves, based on figures quoted by Prof. D. F. Rice, secretary.

The instruction given in the School of Science and Technology is intended for energetic, purposeful young men who have had a certain amount of preliminary training. although graduation from a high school or other equivalent preparatory institution is not required for entrance into this branch of the Institute's work.

In general, the curriculum of the Pratt technology school is of an essentially practical nature, the course continuing only two years. While the work of the school does not profess to be of an engineering grade, the industrial



INCOMES OF GRADUATES OF PRATT INSTITUTE TWO-YEAR COURSE

training administered is expected to prepare men for positions of responsibility in mechanical and electrical plants. Data were gathered from more than 1000 graduates in mechanics, electricity and chemistry, the returns showing that in general the mechanical and chemical students rise more rapidly and to better-paying positions than those in the more popular electrical courses.

Data Concerning Incandescent-Lamp Reflectors

Facts and figures relating to the effectiveness and efficiency of various types of incandescent-lamp reflectors. By G. H. Stickney and A. L. Powell.

THE extensive use of the tungsten-filament lamps has brought on the market so many types and styles of reflectors that it is not a simple matter to make proper selection for particular purposes.

Eliminating the numerous designs of which selection is made principally on the basis of ornamental effect, there are a considerable number of forms making claims for effective distribution of light which may be grouped or classified, and their general characteristics approximately described, without making reference to particular trade names.

In order to obtain specific information concerning these various forms of reflectors, sample reflectors of all known makes in the sizes intended for use with the 100-watt tungsten lamp were secured in the open market and subjected to careful examination and test. This particular size of lamp was chosen as it is the one most frequently used in general commercial work, and also since it is a medium size, and the results obtained on this will give a general indication of what can be expected of the other sizes. The photometric measurements were made in the illuminating engineering laboratory of the General Electric Company at Schenectady, N. Y. Since the information obtained has been found of general interest to lamp users, it has been decided to present it in this article.

The Lamp

In order to eliminate any variations due to lamps, as small a number of lamps as possible was used, and these were carefully checked for rating and with each other. All reflectors were tested with 100-watt clear tungsten lamps, and those frequently used with bowl-frosted lamps were tested with similar lamps with the standard bowl frosting. The tests were actually run with lamps operated at 1.18 watts per mean horizontal candle-power (clear). Since that time the standard rating of the 100-watt lamp has been changed to 1.08 watts per mean horizontal candle-power. In order to make the data as general as possible and most easily convertible for other ratings, all the values have been corrected to correspond to a specific consumption of 1 watt per mean horizontal candle-power. Since this does not involve any change in characteristic distribution, the values simply vary inversely with the ratio of specific consumption.

TABLE I—ILLUMINATION VALUES—100-WATT TUNGSTEN LAMP (WITHOUT REFLECTOR) OPERATED AT 1 WATT PER MEAN HORIZONTAL CANDLE-POWER

	Clear	Bowl-Frosted
Mean lower hemispherical candle-power	83.5	59.5
Mean spherical candle-power	79.5	75.
Lumens in 0–60 deg. zone	209.0	163
Downward lumens (0–90 deg. zone)	524.0	7
Total lumens (0–180 deg. zone)	999.0	43

In comparing the values given in the following tables with other figures, or in comparing different makes of reflectors, it is necessary to refer them to the same basis of lamp efficiency, in order to obtain a fair relation.

The corrected values for the lamps used in the test are given in Table I.

Classification of Reflectors

The commercial types of reflectors may be divided into two main groups, namely, metal and glass. These may be further classified as to composition, shape and finish as follows:

Metal Reflectors.—Shapes: Flat dome; radially fluted; bowl; angle. Finish: Porcelain (fire) enamel; aluminum; paint enamel (baked or air-dried).

Glass Reflectors.—Kinds of glass: Opalescent; clear (prismatic). Types of opalescent: "Alba" type; opal; cased. Types of prismatic: Class A, accurate prisms; class B, inaccurate prisms. Method of forming: Blown; pressed.

Metal Reflectors

Metal reflectors, or, as they are sometimes designated from their principal use, "industrial reflectors," are usually made of steel formed into shape by stamping or spinning, or a combination of the two. Stamping requires expensive dies and hence is commercially practicable only where a large number of reflectors can be stamped at one time. With deep reflectors several sets of dies may be required to draw them into shape.

Porcelain enameling consists of applying what is practically opal glass to the surface. A fusing heat is required. In the better types two or three coats are applied. As this is a rather difficult process, requiring considerable care to produce an even finish and avoid cracks, there is a wide variation among commercial reflectors of different makes. Good heavy enameling appears white or a trifle yellow. A bluish appearance is generally due to the base metal showing through a thin coating of enamel, and it usually means a slightly less efficient reflector on this account.

Brittle enamel should be avoided, as well as too light a metal stock, or else the finish may crack off. In reflectors exposed to moisture, vapor or fumes it is especially essential that all cracks in the enamel (at edges or joints) be covered, otherwise corrosion of the metal is liable to occur, followed by the chipping off of the enamel.

The enamel surface acts principally by diffuse reflection, so that a concentrated distribution cannot be secured without excessive loss of light, although a certain degree of concentration can be secured by the use of a large reflector.

The important advantages of the porcelain enamel are:

(1) It does not readily accumulate dirt and dust, on account of the smooth, glazed surface.

(2) It is easily cleaned. Soap and water, or even a wet cloth, will readily restore the bright, clean surface, even though it has become greasy and soiled from being handled by workmen.

(3) It resists acid fumes and moisture. Unless the finish is cracked, ordinary acid fumes will not have any deteriorating effects. It can be exposed to the weather without injury.

(4) It resists heat. It is not blistered, discolored or in any way affected by ordinary heat such as may emanate from the lamp.

(5) It has no inherent depreciation. An old reflector becomes as efficient as a new one simply by cleaning.

Paint enamel costs considerably less than the porcelain and, when new, is about as effective. However, as it accumulates dust more readily, is not so easily cleaned and will not withstand exposure to moisture, this finish is being used less and less for industrial lighting.

Aluminum Finish.—The aluminum finish is painted or sprayed on the under surface of the reflector, spinning the reflector meanwhile to distribute the paint evenly. The outer surface is then painted with some colored paint.

With the aluminium interior finish it is possible to vary the photometric curve through a wide range. If the finish is not good, there is deterioration through the wearing of the surface in cleaning and the embedding of small dust particles in the pores of the metal. In one make now on the market a coat of lacquer is given to the interior after applying the aluminum finish. This coating closes the pores and gives a smooth, hard surface.

Flat-Dome Type (Porcelain-Enamel Finish.)—These reflectors give a so-called distributive, or wide-angle, type of distribution and are well adapted for use where the spacing is comparatively wide and where general or localized general illumination is required. The maximum candle-power of the reflectors tested is found between the angles of 40 deg. and 60 deg. and is approximately constant throughout the zone. The downward candle-power is increased by using a larger-diameter reflector. Selection is often determined by a compromise between the cost of reflector and the illuminating efficiency. The lumens in the 0 deg. to 60 deg. zone are increased by using a reflector with the edge bent downward, approaching the bowl shape.

TABLE II—ILLUMINATION VALUES—FLAT-DOME-TYPE REFLECTOR, PORCELAIN-ENAMEL FINISH. LAMPS AS PER TABLE I. TEST OF TEN REFLECTORS OF SEVEN DIFFERENT MAKES

	Clear Lamp			Bowl-Frosted		
	Avg.	Max.	Min.	Avg.	Max.	Min.
Mean lower hemispherical cp	123	133.5	111	114	119	98.6
Mean spherical cp	65	72	55.4	59	66	49.3
Decrease in mean spherical cp over lamp without reflector, per cent	18	9	30	21	11	34
Lumens in 0–60 deg. zone	479	571	408	440	508	380
Downward lumens (0–90 deg. zone)	785	839	697	715	753	619
Total lumens (0–180 deg. zone)	820	888	697	741	840	619
Weight in ounces	38½	55	30	....	....	....
Diameter in inches	15¼	20	12	....	....	....

Flat-Dome Type (Aluminum Finish).—These reflectors, acting by spread reflection, can be made to give a number of types of distribution, but, as usually made, they are very shallow, so that there is liability of producing excessive glare, particularly where the units are hung low.

Radial Fluted Type (Porcelain-Enamel Finish).—These give a very wide angle of distribution and are well suited for street or yard lighting, or for use in interiors on low suspension and very wide spacing where high intrinsic brilliancy is not objectionable. The maximum candle-power is at 75 deg., and a little light is allowed to escape above the horizontal to light the surrounding buildings at a low intensity—a desirable condition in street illumination. As with the flat-dome type, the larger the reflector the greater the mean candle-power below the horizontal, for rays in a greater angle are intercepted.

Bowl Type (Porcelain-Enamel Finish.)—The light distribution is extensive (its maximum being at 45 deg.) and serves well for general illumination, with reasonably high hanging and moderate spacing or localized general illumination. Intensive distribution can be obtained by using a relatively large reflector with a given lamp.

The bowl type, while not as efficient with regard to total lumens as the wider reflectors, has the great advantage that the lamp is hidden, thus shielding the eyes from glare. The maximum candle-power varies with the type of distribution.

TABLE III — ILLUMINATION VALUES — RADIAL-FLUTED-TYPE METAL REFLECTOR, PORCELAIN-ENAMEL FINISH. LAMPS AS PER TABLE I. TESTS OF TWO REFLECTORS OF TWO DIFFERENT MAKES

	Clear		
	Average	Maximum	Minimum
Mean lower hemispherical cp	109	112	107
Mean spherical cp	72.8	75	70.8
Decrease in spherical cp over lamp without reflector, per cent	9	7	11
Lumens in 0–60 deg. zone	339	347	330
Downward lumens (0–90 deg. zone)	688	702	673
Total lumens (0–180 deg. zone)	913	936	890
Weight in ounces	40	48	31
Diameter in inches	18	20	16

Bowl Type (Aluminum Finish).—Acting by spread reflection, characteristic extensive, intensive and focusing distributions can be obtained, depending on the shape and position of the reflector. With extensive or intensive distribution, this class is applicable for localized general or general illumination, or, with the more concentrating curves, it is applicable for local lighting and has the advantage of the bowl type. The maximum candle-power is found at angles from 0 deg. to 45 deg., depending on the shape. No one curve is characteristic of the group. One reflector having a maximum efficiency in desired angles may be better adapted for the case in hand, although another may have a higher over-all efficiency.

TABLE IV—ILLUMINATION VALUES—BOWL-TYPE METAL REFLECTOR, PORCELAIN-ENAMEL FINISH. LAMPS AS PER TABLE I. TEST OF FOUR REFLECTORS OF FOUR DIFFERENT MAKES

	Clear Lamp			Bowl-Frosted		
	Avg.	Max.	Min.	Avg.	Max.	Min.
Mean lower hemispherical cp	95.4	101.5	91.3	80.5	81.8	69.2
Mean spherical cp	47.6	50.6	45.6	40.2	41.0	39.7
Decrease in spherical cp over lamp without reflector, per cent	40	36	42	56	55	57
Lumens in 0–60 deg. zone	510	528	503	441	453	426
Downward lumens (0–90 deg. zone)	600	638	574	506	516	497
Total lumens (0–180 deg. zone)	600	638	574	506	516	497
Weight in ounces	22	33	13	....	....	....
Diameter in inches	8¾	9	8¼	....	....	....

Angle Reflectors.—Bowl-shaped industrial steel reflectors, aluminum and porcelain finish, are available with the holder or socket set at various angles, giving asymmetrical light distributions. In the smaller sizes this class finds application in localized machine lighting, art-gallery lighting, stage lighting, etc., and in the larger sizes it is suitable for tennis or athletic court lighting, as well as foundry and

shop lighting, the units being located at the side below the crane tracks. Owing to the asymmetrical distribution the performance is not readily expressed in tabulated data.

GLASS REFLECTORS

There are two general methods in the manufacture of glass reflectors, the blown and the pressed. The blown reflector is of even thickness throughout, as the glass is evenly distributed over the surface of the mold, and the inner surface has the same convolutions as the outer. The inner surface of the pressed reflector is smooth, taking the shape of the plunger, while the exterior follows the outline of the mold. In general, the blown reflector is thinner and hence lighter in weight. The glass in the blown reflectors must be quite dense, or else roughened on one or both surfaces, in order to produce good diffusion. If these requirements are not fulfilled, the ridges and hollows are light and dark, owing to the thinness of the glass, and the reflector does not present an attractive appearance. The pressed reflector, with its greater thickness, can use a lighter density glass yet have good diffusion and be evenly lighted without a roughed surface.

An excellent description of the methods of manufacture of glass reflectors was given in a paper by Mr. E. H. Bostick, entitled "The Manufacture of Glass for Illuminating Purposes," published in the *Transactions* of the Illuminating Engineers' Society, 1911.

TABLE V—ILLUMINATION VALUES—BOWL-TYPE METAL REFLECTORS, ALUMINUM FINISH, EXTENSIVE, INTENSIVE AND FOCUSING DISTRIBUTIONS. LAMPS AS PER TABLE I. TESTS OF FOUR REFLECTORS OF THREE DIFFERENT MAKES

	Clear Lamp			Bowl-Frosted		
	Avg.	Max.	Min.	Avg.	Max.	Min.
Mean lower hemispherical cp	90.6	102	75.8	84.5	97	63.1
Mean spherical cp	45.3	51.3	37.9	41.8	49.3	31.6
Decrease in mean spherical cp over lamp without reflector, per cent	43	35	52	44	34	58
Lumens in 0–60 deg. zone	490	585	376	460	550	328
Downward lumens (0–90 deg. zone)	570	645	475	525	610	397
Total lumens (0–180 deg. zone)	570	645	475	525	610	397
Weight in ounces	11½	13	11	....	....	....
Diameter in inches	8½	9	7	....	....	....

TABLE VI—ILLUMINATION VALUES—BOWL-SHAPE, OPALESCENT-GLASS REFLECTORS, "ALBA" TYPE GLASS (PRESSED). LAMPS AS PER TABLE I. TEST OF FIFTEEN REFLECTORS OF ELEVEN DIFFERENT MAKES

	Clear Lamp			Bowl-Frosted		
	Avg.	Max.	Min.	Avg.	Max.	Min.
Mean lower hemispherical cp	86.2	95.5	75.8	77	85.6	67.8
Mean spherical cp	72	74.8	65.1	67.0	70.0	61.7
Decrease in mean spherical cp over bare lamp, per cent	9.3	6	18	10.5	7	18
Lumens flux in 0–60 deg. zone	358	416	288	315	378	246
Downward lumens (0–90 deg. zone)	543	600	477	480	538	426
Total lumens (0–180 deg. zone)	906	940	815	842	876	775
Weight in ounces	38.5	49	30	....	....	....
Diameter in inches	8⅛	7½	8¾	....	....	....

OPALESCENT OR WHITE-GLASS REFLECTORS

If their interior surface is polished or in its natural state, there is considerable direct reflection from white-glass reflectors. If the interior surface is depolished, little variation is produced in the light-distribution curve by changing the shape of the reflector. The light reflected comes from three sources: (1) the glazed interior surface; (2) the opal particles in the body of the glass; (3) the outer surface, after passing through the body and striking at less than the critical angle.

TABLE VII—ILLUMINATION VALUES—FLARED-SHAPE OPALESCENT-GLASS REFLECTORS, "ALBA" TYPE GLASS (PRESSED). LAMPS AS PER TABLE I. TEST OF TEN REFLECTORS OF TEN DIFFERENT MAKES

	Clear Lamp			Bowl-Frosted		
	Avg.	Max.	Min.	Avg.	Max.	Min.
Mean lower hemispherical cp	100	109	94.5	93	99.6	87.8
Mean spherical cp	72.8	77.5	68.1	70.2	73.3	67.1
Decrease in mean spherical cp over bare lamp, per cent	8	3	14	6.2	2	10
Lumens flux in 0–60 deg. zone	363	418	331	326	366	295
Downward lumens (0–90 deg. zone)	626	684	582	584	628	551
Total lumens (0–180 deg. zone)	915	972	856	880	918	844
Weight in ounces	47	54	37	....	....	....
Diameter in inches	11	11	11	....	....	....

The opalescent reflector is exploited in two principal shapes, bowls and flared. The bowl is made in numerous contours, but the flared reflectors made by the different manufacturers approximate very closely to a standard. An intermediate shape is listed by some of the manufacturers, known as the "semi-flared." As to size, the various companies follow very closely in one another's footsteps. For example, the 100-watt bowl-shape, opalescent reflector is almost always about 8 in. in maximum diameter, and the flare-shape for the same size lamp is 11 in. in diameter.

The bowl type is to be preferred for most uses in that it covers a larger portion of the lamp, so that the filament is not visible at quite so flat an angle as with the flared type. This class of reflector is not so efficient as a mirror or other opaque reflector. They are suitable for use in places where decoration and some upward light are of more importance. Practically none of these reflectors has a smooth exterior surface, all being broken by a number of small prisms or convolutions which are for purely decorative

TABLE VIII—ILLUMINATION VALUES—BOWL-SHAPE, OPALESCENT-GLASS REFLECTORS, OPAL GLASS (PRESSED AND BLOWN). LAMPS AS PER TABLE I. TEST OF THIRTEEN REFLECTORS OF TEN DIFFERENT MAKES

	Clear Lamp			Bowl-Frosted		
	Avg.	Max.	Min.	Avg.	Max.	Min.
Mean lower hemispherical cp	95.8	114	82	84.5	107	71.6
Mean spherical cp	65.3	73	55	59.5	64.5	54.3
Decrease in mean spherical cp over bare lamp, per cent	18.7	9	31	21.2	15	32
Lumens 0–60 deg. zone	430	535	372	377	493	283
Downward lumens (0–90 deg. zone)	600	720	513	478	673	448
Total lumens (0–180 deg. zone)	806	907	681	748	800	678
Weight in ounces	21½	33	13	....	....	....
Diameter in inches	7.8	8	6¾	....	....	....

purposes and have nothing to do with the illuminating efficiency. With almost all of the opalescent reflectors quite a percentage of the total light flux is in the upper hemisphere and serves to illuminate the side walls and ceiling.

"Alba" Type Glass

The distinction between the so-called "Alba" type glass and other opal glass is that the latter appears homogeneous, while the former appears to have innumerable opaque, white particles suspended in clear glass. This glass is employed in several makes of pressed reflectors. The glass in these reflectors is usually quite thick and hence the weight is fairly high. The light diffusion is good, varying as it does almost directly as the thickness of the glass. Absorption is moderate, as is also the reflective power. There is no selective absorption; that is, the color of the light transmitted through the glass is the same as that from the light source. None of the specimens tested had rough surfaces, and hence they were easy to clean.

The distribution of light with the bowl shape is, in general, a mean between that of the extensive and the intensive, the bowl frosting on the lamp tending to concentrate the flux. The flared type gives a light distribution which is widely extensive.

TABLE IX—ILLUMINATION VALUES—FLARED-SHAPE, OPALESCENT-GLASS REFLECTORS, OPAL GLASS (PRESSED AND BLOWN). LAMPS AS PER TABLE I. TEST OF NINE REFLECTORS OF EIGHT DIFFERENT MAKES

	Clear Lamp			Bowl-Frosted		
	Avg.	Max.	Min.	Avg.	Max.	Min.
Mean lower hemispherical cp	111	133	101	100	119.5	94.3
Mean spherical cp	68.4	72.9	64.1	63.3	67.6	61.5
Decrease in mean spherical cp over bare lamp, per cent	14	9	19	15.6	10	18
Lumens 0—60 deg. zone	428	548	387	392	498	332
Downward lumens (0—90 deg. zone)	696	836	630	629	750	568
Total lumens (0—180 deg. zone)	872	919	805	795	850	773
Weight in ounces	30½	45	20	....	....	....
Diameter in inches	11	11¾	10	....	....	....

TABLE X—ILLUMINATION VALUES—BOWL-SHAPE, OPALESCENT-GLASS REFLECTORS, CASED GLASS (BLOWN). LAMPS AS PER TABLE I. TEST OF THREE REFLECTORS OF THREE MAKES

	Clear Lamp			Bowl-Frosted		
	Avg.	Max.	Min.	Avg.	Max.	Min.
Mean lower hemispherical cp	88.1	96	83	78.3	85.6	72.8
Mean spherical cp	69	73.3	61	63.8	68.2	56.4
Decrease in mean spherical cp over bare lamp, per cent	13	8	23	14.7	9	25
Lumens in 0—60 deg. zone	357	373	336	338	417	283
Downward lumens (0—90 deg. zone)	558	603	521	490	537	450
Total lumens (0—180 deg. zone)	864	923	766	795	841	708
Weight in ounces	21	23	18	....	....	....
Diameter in inches	8	8	8	....	....	....

Opal Glass of Varying Densities

This glass is employed in both blown and pressed commercial reflectors. In opal glass the white particles are so small as to be invisible to the naked eye, and hence it has the appearance of uniform whiteness.

The pressed reflectors are invariably thicker than the blown reflectors. With the denser opals diffusion is good and the absorption is quite high. The reflective power is good. Most of the specimens examined absorbed light selectively from the blue end of the spectrum; that is, the transmitted light appears more yellow or red than that from the source. On some of the reflectors the interior surface was roughed to aid diffusion. In many of the light-density opals the diffusion is poor. The downward candlepower and the value of the 0—60 deg. lumens are usually greater than with the "Alba" type glass. The bowl shape gives an extensive curve, while the flared type distributes the light over a wide angle.

TABLE XI—ILLUMINATION VALUES—FLARED-SHAPE, OPALESCENT-GLASS REFLECTORS, CASED GLASS (BLOWN). LAMPS AS PER TABLE I. TEST OF TWO REFLECTORS OF TWO MAKES

	Clear Lamp			Bowl-Frosted		
	Avg.	Max.	Min.	Avg.	Max.	Min.
Mean lower hemispherical cp	105	116	93.7	93.0	104.5	81.5
Mean spherical cp	72.3	72.3	72.3	67.0	67.5	66.5
Decrease in mean spherical cp over bare lamp, per cent	9	9	9	11	10	12
Lumens flux 0—60 deg. zone	415	465	364	356	402	312
Downward lumens (0—90 deg. zone)	655	723	587	581	653	512
Total lumens (0—180 deg. zone)	910	910	910	841	847	835
Weight in ounces	39.5	41	38	....	....	....
Diameter in inches	11	11	11	....	....	....

Cased, Plated, Flashed or "Alabaster" Glasses

In making this type of glass, which is commercially employed in a number of blown reflectors, the workman gathers upon his pipe first a small quantity of white or colored glass and afterward the needed quantity of crystal. When the article is blown there is very evenly applied on the inside a flash or film of the white glass. The glass is thin and the weight low; the diffusion is excellent; the reflective power is between that of the "Alba" and the opal; the absorption is moderate and not selective. The light distribution characteristics are very similar to that of the opal-glass reflectors.

TABLE XII—ILLUMINATION VALUES—BOWL-SHAPE, CRYSTAL, PRISMATIC-GLASS REFLECTORS, ACCURATE PRISMS (PRESSED). LAMPS AS PER TABLE I. TEST OF FOUR REFLECTORS OF VARIOUS DISTRIBUTIONS; ONE MAKE

	Clear Lamp			Bowl-Frosted		
	Avg.	Max.	Min.	Avg.	Max.	Min.
Mean lower hemispherical cp	114	117	111	104	108	99
Mean spherical cp	72.3	73.6	70.7	67.8	70.2	66.1
Decrease in mean spherical cp over bare lamp, per cent	9	7	11	9.5	6	12
Lumens 0—60 deg. zone	540	564	501	485	529	433
Downward lumens (0—90 deg. zone)	717	734	698	651	678	622
Total lumens (0—180 deg. zone)	908	926	888	855	885	830
Weight in ounces	27	29	27	....	....	....
Diameter in inches	9¼	11	8	....	....	....

Prismatic Reflectors

The prismatic glass reflector, while treated last in this article, really antedates all the other forms of reflectors

described, and there are probably more of this type of reflector in use to-day than of any of the other classes.

Prof. André Blondel, of Paris, was the first to apply the principle of changing the angle of light and at the same time obtaining diffusion by means of prisms. To obtain the best results each prism must be calculated with reference to the light source in its correct position. This makes desirable the use of the holder which the manufacturers recommend with a certain lamp and reflector combination. Since the prismatic reflectors act by direct reflection, any desired distribution is obtainable. One manufacturing company in America, which controls the fundamental patents, has on the market a large variety of types. A standard line, giving the distributions mentioned above, is available in all sizes of the tungsten-filament lamp. Other lines have been developed of a more decorative nature for use in residences, stores, etc. As stated, the light distributions vary widely, and these reflectors are applicable for general illumination with almost any height and spacing, or for localized lighting. For any given height and spacing the proper reflector should be chosen, and the manufacturer's engineers have prepared tables and charts showing the proper combinations.

Other companies market prismatic reflectors which may have been correctly calculated when originally designed but apparently have not been redesigned to accommodate correctly the newer forms of tungsten-filament lamps. As these reflectors act by direct reflection, the light distributions vary widely.

TABLE XIII—ILLUMINATION VALUES—BOWL-SHAPE, CRYSTAL, PRISMATIC-GLASS REFLECTOR, INACCURATE PRISMS (PRESSED). LAMPS AS PER TABLE I. TEST OF TWELVE REFLECTORS OF SEVEN MAKES

	Clear Lamp			Bowl-Frosted		
	Avg.	Max.	Min.	Avg.	Max.	Min.
Mean lower hemispherical cp	94.0	102	85.2	81.8	94.5	72.5
Mean spherical cp	68.3	71.9	64.8	63	66.8	57.1
Decrease in mean spherical cp over bare lamp, per cent	14	10	18	16	11	24
Lumens in 0–60 deg. zone	371	448	314	328	400	276
Downward lumens (0–90 deg. zone)	590	641	535	515	594	458
Total lumens (0–180 deg. zone)	760	905	814	793	840	717
Weight in ounces	25	33	21	....	....	....
Diameter in inches	7½	8½	6	....	....	....

In conclusion, we may briefly sum up the points to be considered in the choice of a reflector, mentioning the factors which must receive consideration. The various items here noted are arranged, as far as possible, in the order of their importance with reference to the two principal uses.

INDUSTRIAL

(a) Protection of the eyes of the workmen.

(b) Efficiency.—As a rough measure of the relative efficiencies of the various reflectors, the following empirical comparison has often proved of value: Assume all the lumens in the 0—60 deg. zone and one-half the remaining lumens as useful.

(c) Distribution.—The reflector chosen should produce the desired intensity at a given spot with a certain hanging height.

(d) Strength and durability.—This naturally includes ease of cleaning and resistance to blows.

(e) Holding device.—This must be such that the reflector cannot be jarred loose.

(f) Protection of bare-metal parts.—For out-of-door use this is very important.

(g) Appearance and general workmanship.

(h) Cost.

DECORATIVE AND SEMI-DECORATIVE

(a) Prevention of the lamp filament from being in the line of vision.

(b) Appearance.—The units, both cold and lighted, should blend with the general artistic scheme and harmonize with the fixtures.

(c) Diffusion.—Lack of this quality usually results in a glaring condition and also an unattractive appearance.

(d) Efficiency.

(e) Distribution.

(f) Ease of cleaning.

(g) Weight.

(h) Cost.

Turning Gas-Lamp Posts Into Tungsten Standards

At New Orleans good use has been made of a number of discarded gas-lamp posts by converting them into modern attractive tungsten lighting standards carrying one, two or four lamps, as desired. The old gas fixtures ended in a hollow-cone frustum carrrying the former lantern. At small cost a casting was designed to fit over this conical member, supporting in a groove on its upper edge the tungsten opal ball. Another casting with a similar base forms the central member of the double-armed fixture shown in the accompanying illustration. This may also be adapted to support four arms. After the first outlay for the patterns was met the cost of the pieces was but a few cents per pound. The two-lamp post shown above was converted by the New Orleans Railway & Light Company.

RECONSTRUCTED GAS-LAMP POST IN NEW ORLEANS PARK

Syndicate Interests in Central Stations

Statistical analysis of number of plants operated by holding companies or other controlling interests, and by independent owners and municipalities

TABLES herewith give the results of an investigation recently made primarily to show the number of electrical plants owned or controlled by syndicate interests and the number owned independently. In connection with the same study the number of municipally owned plants was tabulated. The statistics were confined to towns and cities of 1000 population or over. They are divided so as to show the results separately in communities of 1000 to 5000 population, 5000 to 10,000 population, 10,000 to 50,000 population, 50,000 to 100,000 population, and over 100,000 population The results are shown by states.

TABLE I—INDEPENDENT TOWNS BETWEEN 1000 AND 5000 POPULATION

	Number	Population	Average
New England States	218	473,129	2270
Eastern States	357	799,491	2239
Middle States	585	1,187,321	2029
Southern States	461	979,214	2124
Western States	321	660,686	2089
Total	1942	4,099,841	2111

The totals for the entire country, eliminating, of course, the communities under 1000 population, show that, out of 4774 plants, 29 per cent have syndicate affiliations, 48 per cent are independent and 23 per cent are municipal.

The data from which the figures were compiled were taken from the McGraw Electrical Directory, Poor's Manual of Industrials and Moody's Manual. The properties listed as controlled by syndicate interests are those in which there is a well-defined or widely known affiliation with an interest, usually large, that controls other similar properties. This affiliation of course has different forms. The connection may be through a holding company, an influential individual director, a common president or leading executive, or an engineering firm that is recognized as a dominant factor. The syndicate interests total 110.

Table I is reproduced to show the average population of the towns listed between 1000 and 5000 population, which is found to be 2111.

Table II shows the figures briefly, divided into groups of states. This table indicates that the largest proportion of syndicate plants is in the Eastern States with the next largest in the New England States; the Western States are third, the Middle States fourth and the Southern States fifth. The proportion of independent plants, according to the compilation, is largest in the Southern States, with the other groups of states following in the order named: New England, Western, Eastern and Middle. The percentage of municipal plants is largest in the Middle States, with the Southern States next and the Western States third.

Table III shows the detail figures of the distribution between syndicate, independent and municipal plants. It indicates that the proportion of syndicate plants becomes larger as the size of the communities increases. Thus the proportion of syndicate plants advances from 20 per cent of the total number of plants for the smallest towns in the compilation to 44 per cent in the next group, that based on the returns from communities of 5000 to 10,000 population. In the group of cities from 10,000 to 50,000 population, 63 per cent of the plants, according to the statistics, are in the hands of syndicates, while in the next larger group, based on the returns from cities of 50,000 to 100,000 population, the proportion is 84 per cent. In the cities of the largest size the proportion is 87 per cent.

Conversely, the proportion of independent plants decreases as the size of the community increases. Where the proportion of independent plants was 55 per cent of the total in the towns of 1000 to 5000 population, it decreased to 35 per cent in the towns of the next larger group with between 5000 and 10,000 population. In the group of cities of 10,000 to 50,000 population the proportion was 26 per cent. In the group of cities of 50,000 to 100,000 population the proportion was 10 per cent and it was the same in cities of the largest size.

The proportion of municipal plants decreases as the size of the community increases. Where it was 25 per cent of the total for the towns of 1000 to 5000 population it was 21 per cent in the next larger group. The proportion was 11 per cent in the cities of 10,000 to 50,000 population, 6 per cent in the next larger group and 3 per cent in the group of the largest cities.

The figures should not be taken as an indication that the service in the towns and cities listed is furnished exclusively either by a syndicate, an independent or a municipal plant. In other words, a given town or city may have a syndicate plant, one or more independent plants and a municipal plant. In such a case, the total number of the plants furnishing electrical service would be listed under the respective headings in the table.

TABLE II—CENTRAL STATIONS BY GROUPS OF STATES

	Syndicate Control			Independent		Municipal		Total
	Number of Syndicates	Central Stations	Per Cent	Number	Per Cent	Number	Per Cent	
ew England States	6	224	40	283	50	55	10	562
Eastern States	5	385	43	433	47	91	10	909
Middle States	9	363	22	717	45	524	33	1604
Southern States	13	170	17	534	55	273	28	977
Western States	15	252	35	354	49	116	16	722
Total	48	1394	29	2321	48	1059	23	4774

TABLE III—ELECTRIC CENTRAL-STATION PLANTS OF THE UNITED STATES IN TOWNS AND CITIES OF MORE THAN 1000 POPULATION

	In Cities of 1,000-5,000 Population				In Cities of 5,000-10,000 Population				In Cities of 10,000-50,000 Population				In Cities of 50,000-100,000 Population				In Cities of Over 100,000 Population				Grand Total			
	Syndicate Control	Independent	Municipal	Total	Syndicate Control	Independent	Municipal	Total	Syndicate Control	Independent	Municipal	Total	Syndicate Control	Independent	Municipal	Total	Syndicate Control	Independent	Municipal	Total	Syndicate Control	Independent	Municipal	Total
1. Alabama	10	20	24	54	2	3	1	6	3	1	1	5	1	0	0	1	1	0	0	1	17	24	26	67
2. Arizona	3	6	0	9	4	1	0	5	2	0	0	2	0	0	0	0	0	0	0	0	9	7	0	16
3. Arkansas	3	36	13	52	2	3	1	6	3	1	2	6	0	0	0	0	0	0	0	0	8	40	16	64
4. California	53	51	7	111	10	1	0	11	18	2	3	23	0	0	0	0	6	0	0	6	87	54	10	151
5. Colorado	15	19	4	38	5	2	0	7	3	0	0	3	0	0	0	0	1	0	0	1	24	21	4	49
6. Connecticut	14	38	2	54	9	10	1	20	4	8	2	14	1	0	0	1	2	1	0	3	30	57	5	92
7. Delaware	0	6	6	12	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	6	6	13
8. Florida	7	16	10	33	0	3	2	5	3	0	0	3	1	0	1	2	0	0	0	0	11	19	13	43
9. Georgia	4	26	44	74	3	2	9	14	5	2	0	7	1	0	0	1	1	0	0	1	14	30	53	97
10. Idaho	8	17	2	27	1	3	0	4	1	0	0	1	0	0	0	0	0	0	0	0	10	20	2	32
11. Illinois	73	109	54	236	21	16	4	41	23	3	3	29	5	0	0	5	1	0	0	1	123	128	61	312
12. Indiana	13	63	46	122	11	11	7	29	12	4	6	22	3	1	0	4	1	1	0	2	40	80	59	179
13. Iowa	7	91	39	137	1	8	1	10	13	4	1	18	1	0	0	1	0	0	0	0	22	103	41	166
14. Kansas	4	45	34	83	4	2	5	11	7	1	1	9	4	0	1	5	0	0	0	0	19	48	41	108
15. Kentucky	6	44	7	57	6	5	1	12	3	0	3	6	1	0	0	1	1	0	0	1	17	49	11	77
16. Louisiana	0	16	14	30	0	2	4	6	3	2	2	7	0	0	0	0	1	0	0	1	4	20	20	44
17. Maine	18	54	2	74	10	4	1	15	4	2	1	7	1	0	0	1	0	0	0	0	33	60	4	97
18. Maryland	0	22	2	24	0	4	0	4	0	3	3	6	0	0	0	0	0	1	0	1	0	30	5	35
19. Massachusetts	47	53	12	112	25	13	16	54	26	13	5	44	2	3	1	6	4	1	0	5	104	83	34	221
20. Michigan	17	51	66	134	8	8	10	26	12	6	4	22	1	0	0	1	2	0	0	2	40	65	80	185
21. Minnesota	5	38	62	105	2	8	6	16	3	1	1	5	1	0	0	1	2	0	0	2	13	47	69	129
22. Mississippi	0	25	28	53	0	7	4	11	4	1	0	5	0	0	0	0	0	0	0	0	4	33	32	69
23. Missouri	10	57	48	115	9	4	5	18	4	2	1	7	1	0	0	1	2	0	0	2	26	63	54	143
24. Montana	5	12	2	19	3	0	0	3	5	1	0	6	0	0	0	0	0	0	0	0	13	13	2	28
25. Nebraska	4	39	23	66	3	4	2	9	2	1	0	3	0	0	0	0	1	0	0	1	10	44	25	79
26. Nevada	2	8	0	10	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	3	8	0	11
27. New Hampshire	9	48	3	60	2	3	0	5	2	5	0	7	1	0	0	1	0	0	0	0	14	56	3	73
28. New Jersey	60	36	3	99	22	0	1	23	20	3	0	23	6	0	0	6	3	0	0	3	111	39	4	154
29. New Mexico	1	12	1	14	1	2	0	3	1	0	0	1	0	0	0	0	0	0	0	0	3	14	1	18
30. New York	36	151	31	218	11	9	5	25	24	18	4	46	5	0	0	5	4	1	0	5	80	179	40	299
31. North Carolina	7	21	28	56	2	4	9	15	5	2	0	7	0	0	0	0	0	0	0	0	14	27	37	78
32. North Dakota	0	18	7	25	1	2	0	3	2	0	0	2	0	0	0	0	0	0	0	0	3	20	7	30
33. Ohio	22	75	65	162	17	16	13	46	15	11	3	29	2	0	0	2	5	0	0	5	61	102	81	244
34. Oklahoma	7	43	38	88	4	4	1	9	5	2	0	7	1	0	0	1	0	0	0	0	17	49	39	105
35. Oregon	17	17	2	36	2	4	0	6	1	0	0	1	0	0	0	0	1	0	0	1	21	21	2	44
36. Pennsylvania	107	142	20	269	42	21	11	74	36	14	4	54	5	2	0	7	3	0	1	4	193	179	36	408
37. Rhode Island	14	1	0	15	7	0	0	7	6	1	0	7	1	0	0	1	1	0	0	1	29	2	0	31
38. South Carolina	7	21	12	40	3	2	4	9	2	1	0	3	1	0	0	1	0	0	0	0	13	24	16	53
39. South Dakota	1	23	5	29	2	2	0	4	1	1	0	2	0	0	0	0	0	0	0	0	4	26	5	35
40. Tennessee	0	31	25	56	2	2	0	4	3	1	0	4	0	0	0	0	2	0	0	2	7	34	25	66
41. Texas	4	155	6	165	9	10	2	21	14	3	2	19	4	0	1	5	0	0	0	0	31	168	11	210
42. Utah	6	14	11	31	2	0	1	3	1	0	0	1	1	0	0	1	0	0	0	0	10	14	12	36
43. Vermont	7	24	9	40	4	1	0	5	3	0	0	3	0	0	0	0	0	0	0	0	14	25	9	48
44. Virginia	7	26	8	41	1	5	1	7	6	2	1	9	1	0	0	1	1	0	0	1	16	33	10	59
45. Washington	23	30	3	56	3	1	1	5	5	0	0	5	1	0	0	1	2	0	1	3	34	31	5	70
46. West Virginia	10	24	2	36	1	6	0	7	3	3	1	7	0	0	0	0	0	0	0	0	14	33	3	50
47. Wisconsin	8	58	38	104	6	10	2	18	6	12	0	18	0	0	0	0	1	0	0	1	21	80	40	141
48. Wyoming	1	10	0	11	1	2	0	3	0	1	0	1	0	0	0	0	0	0	0	0	2	13	0	15
Total	682	1942	868	3492	284	230	131	645	325	138	54	517	54	6	4	64	49	5	2	56	1394	2321	1059	4774
Per cent	20	55	25	100	44	35	21	100	63	26	11	100	84	10	6	100	87	10	3	100	29	48	23	100
Per cent of grand total, corresponding columns	49	81	82	73	20	9	12½	13	23	6	5	11	4	2	½	1½	4	2	0	1½	.....	.....	.....	.....
Per cent of all plants	14	41	18	73	6	4	3	13	7	3	1	11	1	0	0	1½	1	0	0	1½	29	48	23	100

Column "Syndicate Control" indicates those believed to be controlled by holding companies, bankers and prominent individuals or firms. "Independent" column includes plants, not municipal, which are not under syndicate control. Data obtained from McGraw's Electrical Directory, Poor's Manual of Industrials, and Moody's Manual.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

The Electric Fan in the Perfume Salesroom

It was a wise confectioner who put an electric fan in his salesroom doorway to project the appetizing odors of his shop into the street where they greeted the olfactories of the passing crowd.

Similar beneficent use of a fan is being made by a famous perfumery merchant in the French quarter of New Orleans, La. M. D. R. Constant Pichet, whose shop on Bourbon Street has for years been furnishing special scents to the aristocracy of the South, has an electric fan mounted on his counter just inside the door. Behind the fan is a perfume atomizer, and when the fugitive fragrance of the little storeroom is depleted by the strong outward draft into the street the Gallic attendant presses the atomizer bulb, once more sending sweet scents of Arcadie into the quaint old-world thoroughfare outside.

Remedy for Electric-Vehicle Trouble

The electric trucks employed in delivering keg beer for a brewery in a northern Indiana town caused much complaint and were said to be depreciating at a rate which rendered it almost imperative for the brewery to return to the use of horse-drawn trucks. The manufacturers and central-station representatives were consulted, and the central-station man, who was a shrewd judge of human nature, suggested that a "speedograph" be put on one vehicle that a graphic record might be made showing what the truck did each day.

The instrument was installed without the knowledge of the driver, and on his return from the day's trip the speedograph record was compared with the driver's own verbal account of length of stops, speed between stops, etc. The disagreement between the verbal account and the speedograph record of the trip was surprising and exceedingly enlightening. It was found that the truck driver had been loafing and consuming the brewery's product for approximately thirty minutes at each stop and had been exceeding the speed limit and pushing the truck to its utmost capacity between stops, with absolutely no regard to road conditions or other factors which should influence a driver's judgment.

Since the dismissal of the driver who presented the false oral report it is now stated that the trucks are giving excellent service and a wonderful drop in vehicle maintenance charge has been discovered.

A Commercial-Truck Cost Comparison

The average city should support one electric commercial truck for every 1000 of its population, declared Mr. H. W. Hillman, of the General Vehicle Company, Long Island City, N. Y., in a paper presented by him before the Macon (Ga.) convention of the Southeastern Section, N. E. L. A. The exact figure will vary somewhat with the policy of the local central station, but the methods which have been used successfully in such cities as Hartford, Conn., Vancouver, B. C., Baltimore, Md., and other places cited by the author tend to show that the saturation point will be reached somewhere in the vicinity of one truck per 1000 inhabitants. In the accompanying table, presented as a supplement to Mr. Hillman's paper, there is given a comparison of the costs of operating a 2-ton electric truck, a 2-ton gasoline truck and a two-horse wagon with one extra horse. The conditions assumed represent furniture-delivery service, the average load being about 4000 lb. with average trips of 12 miles each, the calls averaging about one to the mile. For loading, 0.7 hour per trip is allowed, with six-minute stops per call and a nine-hour working day. The data are taken from researches conducted by the Massachusetts Institute of Technology.

RELATIVE COST OF OPERATION, ELECTRIC COMMERCIAL VEHICLES

Vehicle	4,000-Lb. Electric	4-000-Lb. Gasoline	Two-Horse Wagon; One Extra Horse
Average running speed, miles per hour	8	9	5
Hours per trip, standing	1.9	1.9	1.9
Hours per trip, moving	1.5	1.4	2.4
Hours per trip, total	3.4	3.30	4.3
Average number trips per nine-hour day	2.65	2.75	2.1
Miles per day	32	33	25
Calls per day	32	33	25
Days used per year	285	270	285
Vehicle-miles per year	9100	9000	7150
Calls per year	9100	9000	7150
Expense, annual:			
Tires or shoeing, etc	$225	$270	$108
Repairs	260	550	125
Battery	270	.....	.....
Veterinary	.....	.....	18
Lubricants	15	50	.....
Electricity, at 3 cents per kw-hr.	200	.....	.....
Gasoline, at 16 cents per gal.	.....	285	.....
Feed	.....	.....	570
Garage or stable	220	220	220
Driver and helper	1140	1215	1140
Depreciation	240	500	210
Interest	84	96	31
Insurance	140	180	35
Total annual expense	$2794	$3366	$2457
Cost per day	9.75	12.50	8.60
Cost per call	0.31	0.38	0.35
Cost per mile	0.31	0.38	0.35

SUMMARY (VALUES IN CENTS PER MILE)

	Electric	Gasoline	Horse
Electricity, gasoline or feed	2.2	3.2	8.0
Maintenance	8.5	9.7	3.5
Storage, driver and helper	14.9	15.9	19.1
Overhead charges	5.1	8.6	4.0
Total	30.7	37.4	34.6

Ice-Making an Ideal Adjunct

"Properly operated I believe that ice-making is an ideal adjunct to a small electric-light plant," comments an Ohio central-station man who has served as superintendent for a combination ice-electric station in a town of 4000 population. "My advice to a small company contemplating installing ice machinery would be to get an experienced and successful ice-making expert to go over the local conditions and get up plans and specifications. In building a new plant as an adjunct to an existing electric station with condensing prime-movers I would recommend installing a motor-driven compressor, employing also a raw-water system to avoid the bother of distilling, skimming, reboiling, filtering, etc."

Prize Winner in Chicago Washing-Machine Contest

In all some 500 persons contributed replies to the washing-machine contest recently conducted by the Electric Shop, Chicago, the plan of which, as mentioned in these columns, was to offer a Federal electric washer worth $85 to the person estimating nearest the amount of saving possible in one year by the use of such an outfit.

The campaign was started by a number of newspaper advertisements which illustrated the machine and gave full details of the contest including blanks to be filled out by the contestants. Each contestant was then to write a twenty-five word article on the advantages of using an electric washing machine in the home. Circulars giving these details were handed to customers at the Electric Shop and were inclosed with bills.

Replies began to come in almost immediately, and while some estimates were entirely beyond reason, the majority showed that the matter had been carefully considered and the saving figured out upon a logical basis.

Twenty-three judges were selected from representative Chicago business men to pass on the contest. They awarded the prize to Mr. O. P. Tidd, whose estimate of savings is printed herewith. For comparison the column at the right gives the figures prepared by the judges.

At the close of the contest letters were sent to all taking part, announcing the result, thanking each contestant for his interest, and stating that a representative of the Electric

WINDOW DISPLAY ANNOUNCING CONTEST

Shop would call to thank him personally for the trouble taken. The salesman then followed these letters.

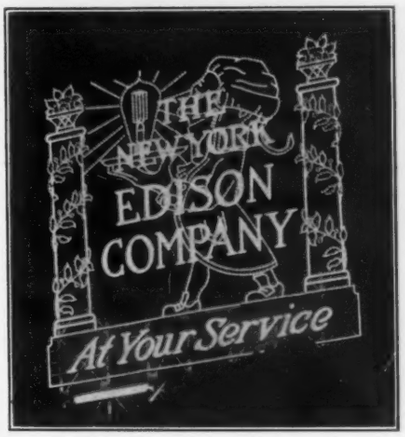
As all of the contestants were obviously already convinced of the saving to be effected by an electric washer, it was not difficult to secure orders from those who were not already using the machines. The estimates and savings and the articles submitted afford very good matter for future advertisements, and altogether the campaign proved far more successful than had been expected even by its enterprising projectors.

ESTIMATED SAVING BY USE OF WASHING MACHINE

	Prize-Winning Estimate	Judges' Estimate
Wages to servants and washwomen	$63.00	$78.00
Food and carfare to servants and washwomen	8.40	18.20
Labor	22.00	22.00
Fuel	6.30	6.30
Soap	4.50	4.50
Wear and tear on clothing and materials washed	13.50	13.50
Tearing out buttons	0.60	1.67
Laundry damage, such as marks of iron rust, etc	1.30	2.50
Laundry losses	2.70	2.75
Cleaners' bills	6.00	6.00
Time	37.80	20.20
Space	10.50	4.50
Damage from quantities of steam in the room	2.75	2.75
Long boiling	1.00	1.00
Health	4.20	.....
	$184.55	$183.87

Advertising Electric Service in New York

A large flashing roof sign 50 ft. square has just been erected by the O. J. Gude Company for the New York Edison Company on the roof of the Columbia Theater building, at Forty-seventh Street and Seventh Avenue. The sign is placed diagonally across the top of the building, and from its commanding position can be seen in all parts of Long



ROOF SIGN FOR NEW YORK EDISON COMPANY

Acre and Times Squares. There are 2800 10-watt tungsten lamps used in the sign, which is lighted from approximately one-half hour after sunset to one-half hour after midnight each night. The sign combines the company's name and its trademark, the Edison man. First the Edison man is flashed and then the company's name. The effect is brilliant, and the sign as a whole is one of the most conspicuous and pleasing of the many marvelous exhibitions of the kind in that vicinity. The illustration shown herewith gives some little idea of its appearance.

Shutting Down a 1425-kw Isolated Plant at Macon, Ga.

The comparatively new 1425-kw steam-turbine isolated plant at the Central Railroad of Georgia shops, Macon, Ga., has now been shut down, and energy to operate the 3500 hp in motors in the great shops is being furnished from

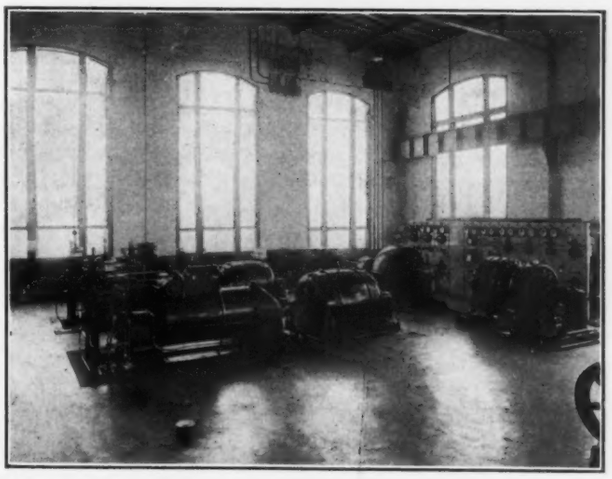


FIG. 1—1425-KW ISOLATED PLANT AT MACON SHOPS

the central-station lines of the Central Georgia Power Company, of Macon, Ga.

As shown in the accompanying illustration, the isolated-plant equipment consisted of three 440-volt, 60-cycle, three-phase Westinghouse turbo-alternator sets, of ratings re-

spectively 300 kw, 500 kw and 625 kw. There are also a 200-kw motor-generator set and a 300-kw rotary converter, used to supply direct current for the operation of a number of variable-speed motors in the machine shops. Direct current is distributed throughout the plant at 250 volts, while the standard distribution pressure for the alternating-current lines is 440 volts. The total lighting and motor connected load aggregates 3500 hp, but the load-factor observed under ordinary operating conditions is about 25 per cent.

The railroad company purchases its central-station energy at its premises at 6600 volts and provides its own transforming equipment for connection to the isolated-plant bus from which the imported energy is distributed. Under its new operating conditions the shop management thus effects a considerable saving over the former isolated-plant costs. If necessary, however, the central station reserves the right to transfer the shop load back to the railroad's plant during three months of heavy winter load, as well as at other times of heavy peak demand. As the shop boilers have to keep up steam to operate a large air compressor, relay service is always available.

Besides the varied use of motors—chiefly individual drive—in the shops, electrical energy is largely employed for welding and for building up repair parts. A special electric-welding motor-generator set has leads extended to

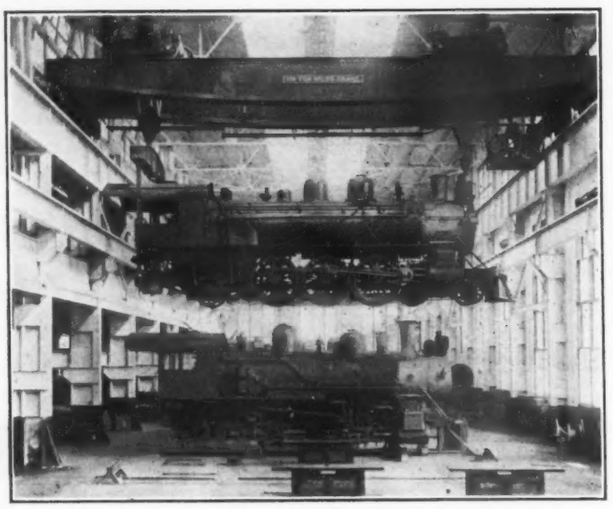


FIG. 2—120-TON ELECTRIC CRANE LIFTING PASSENGER LOCOMOTIVE

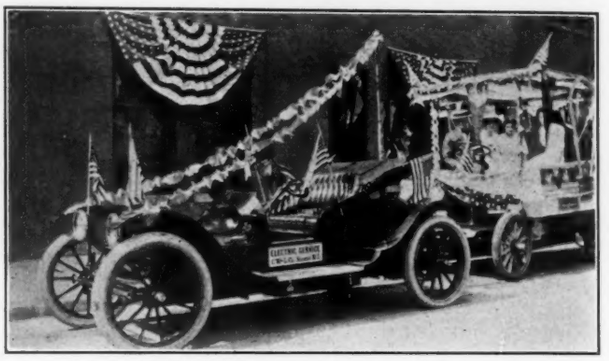
numerous plugs located in the various bays of the locomotive repair shop so that work can be done directly on any part of a dismantled engine undergoing repairs. Fig. 2 shows a 120-ton Niles electric crane transferring bodily one of the largest locomotives in use by the Central of Georgia Railroad.

Distributing Central-Station Prizes at Summit, N. J.

One of the most attractive entries in a recent holiday parade at Summit, N. J., was the electric truck of the local "electric-service company," the Commonwealth Water & Light Company, which was accorded the first prize by the judges. The truck was decorated with tungsten-lamp emblems, bunting and flags, and on each side it carried a large lamp model built on a wooden frame with iron wire for the supports and white tape for filaments.

The feature of the traveling exhibit, however, was the distribution of prize cartons representing chances on 150 electric-appliance premiums, ranging from flatirons to lamps. From the truck were handed out 600 of these tungsten-lamp carton boxes in each of which was pasted a blank coupon like the one reproduced.

Of the total 600 slips 150 were good for premiums, and of the number returned 171 were accompanied by names and addresses of good "prospects" for either new or additional service. Each box also contained several small pamphlets, one showing the relation between increased cost of living and decreasing electric rates, while another gave the history and meaning of the word "Mazda," a booklet on



READY TO DISTRIBUTE PRIZE CARTONS AT SUMMIT, N. J.

wiring, a blotter and a return post card. It was necessary for the holder of a box to take it home over night, this making it likely that the contents would be read and that

PREMIUM BOX NO. 398.

Fill in your name and address and present this box at the office of the COMMONWEALTH WATER & LIGHT COMPANY, Beechwood Road and Bank Street. This box must be presented by an adult. Only one premium will be allowed in one family, living in one house. If more than one box is presented by one person, all of the boxes must be given up and not more than one premium will be allowed therefor. One box in every four draws a premium. No premium will be allowed after July 7, 1913.

Mr. .....

Town .....

Street and No .....

the boxes would be kept off the streets. In the parade the company's electric roadster preceded the truck, as shown in the illustration.

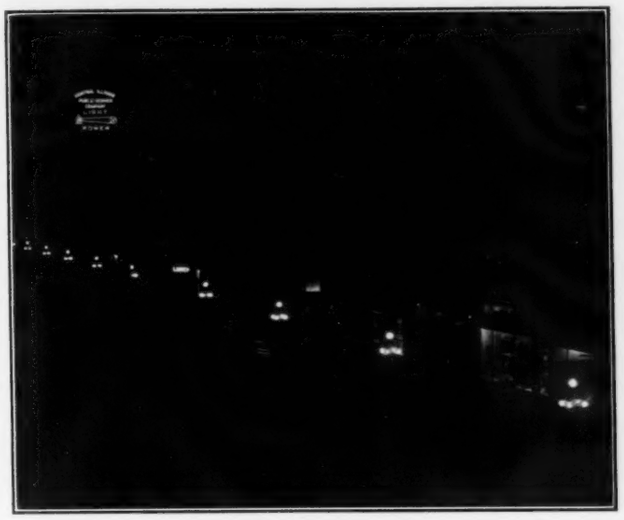
An Electric-Fan Estimating Contest

The attention of passers-by on Canal Sreet, New Orleans, was recently attracted by an estimating contest under way in the display window of the Consumers' Electric Light & Power Company, the purpose of the contest being to calculate how much energy a 12-in. Westinghouse electric fan would consume running fifteen hours a day for seventeen days. The fan was controlled by a time-switch which automatically turned it on and off, and its consumption was registered by a watt-hour meter whose dial was closed and sealed against inspection. The public was invited to offer estimates, and the sales staff stood ready to explain to all comers the method of calculation. A prize of $1 was offered to the contestant making the nearest estimate. At the end of the seventeenth day when the meter was opened the registration showed 6.4 kw-hr., making the cost of operating the fan, at 10 cents per kw-hr., $0.64 for the seventeen-day run. Supplementing the contest announcement was a placard explaining that such a 12-in. fan could be operated four hours per day at a cost of $0.30 per month, eight hours per day for $0.60 per month, and all night long for $0.90 per month.

Illumination and Wiring

Ornamental Lighting at Mattoon, Ill.

The accompanying illustration shows part of the ornamental tungsten lighting system installed at Mattoon, Ill., and operated from the lines of the Central Illinois Public

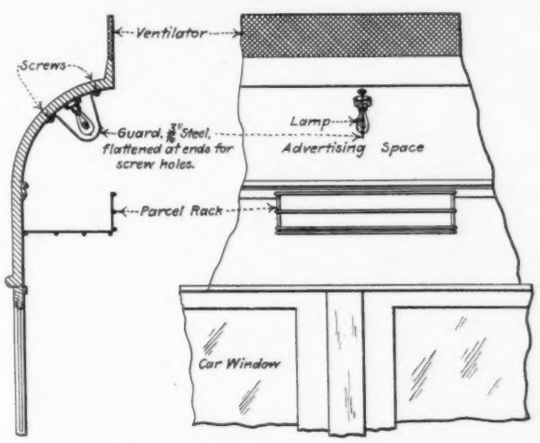


ORNAMENTAL TUNGSTEN LIGHTING AT MATTOON, ILL.

Company. At the end of the street is also seen the large new central-station sign of the Central Illinois company, showing a motor belt-connected to a pulley, the entire display having the appearance of rapid motion given to it by means of a flasher. Each of the ornamental lighting standards carries four 40-watt tungsten lamps and one 60-watt lamp. This tungsten lighting system is operated by the city of Mattoon from dusk to midnight.

Inexpensive Lamp Guard for Interurban Cars

Following the installation of tungsten lamps on its interurban cars operating between Fort Wayne, Ind., and Lima, Ohio, the Ohio Electric Company discovered that a large



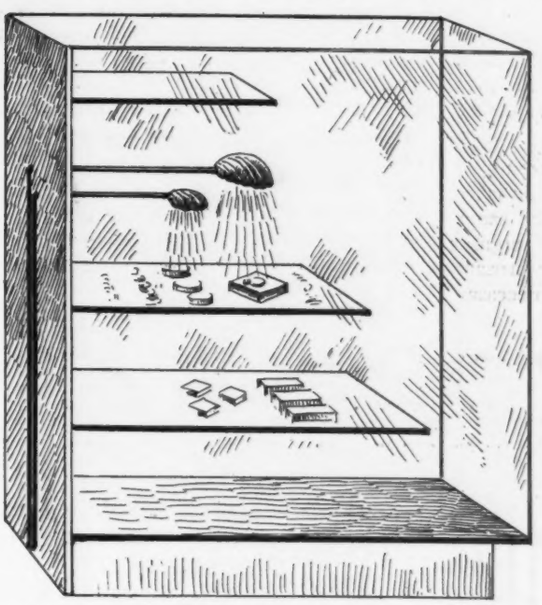
LAMP GUARD FOR INTERURBAN CARS

percentage of lamp breakage was due to the careless passenger who tossed his suitcase, grip or parcel into the parcel rack without noticing the tungsten lamp above the rack. A number of small steel rods 3/16 in. in diameter were therefore bent as shown in the illustration and flattened at each end to receive holes for the wood screws which hold them in place. These rods, when fastened to the woodwork of the car above the advertising space, protect the lamps and are said to have reduced the breakage from the above cause without in any way impairing the efficiency of the illumination or obstructing speedy lamp renewals. The cost of the guards was found to be slight in comparison with former lamp bills.

Influencing the Curio Seekers' Choice Electrically

When the proprietor of a certain little curio shop in the city of Niagara Falls, N. Y., wishes to push the sale of any article or to emphasize the presence of any timely trinket in his showcase he does so by simply changing its position in the case. As is shown in the illustration, auxiliary illumination is furnished by 10-watt tungsten lamps supported by extension arms and shades so as to throw the full intensity of their light upon the object beneath them. Catching the eye on account of its comparatively greater illumination, the tourist's attention is immediately directed to the very article which the shrewd shopkeeper is anxious to dispose of first.

The low price of electrical energy in the Power City



INFLUENCING THE CURIO SEEKERS' CHOICE ELECTRICALLY

makes it practicable for shopkeepers to burn lamps all day as well as during the evening hours in places where illumination will increase the volume of the sales.

An Improvised Pendent Switch

BY ROGER P. HELLER

A pendent switch being urgently needed and none being at hand, the writer recently made use of an ordinary key socket with a rubber cord-bushing. The insulating collar and the brass shell or clamp for holding the lamp base were removed and the device was short-circuited by screwing a copper washer, about the size of a dime, under the central screw originally intended to connect with the center stud on the lamp. The open socket was then plugged with a cork of suitable size, pushed in flush, with the exposed end blackened with india-ink, after which it was treated to a coat of shellac.

This arrangement was found preferable to the ordinary push-button pendent switch, as the latter must be steadied by the fingers or the other hand, whereas the improvised switch requires only a simple twist on the key, the counterbalancing torque being met by the cord.

Electric Vacuum Cleaner for Fishing Conduit

A Richmond (Ind.) contractor was perplexed as to how to "fish" wires through a 0.375-in. gas pipe for a newel-post lamp. The pipe had three bends in it and could not be disconnected. A friend suggested to him that he get an electric vacuum cleaner on the job. When the cleaner was brought the two men took a piece of string and made a ball of the string nearly as large as the opening in the pipe. Leaving the remainder of the string attached, they inserted the ball in one end of the pipe and put the smallest nozzle on the cleaner hose at the other end and sucked it through. The entire operation took about two minutes, and after they had a string through the pipe they were able to draw the wires after it without any further trouble. By this method they accomplished a task in less than five minutes which a man had tried to do by hand for the greater part of the previous day.

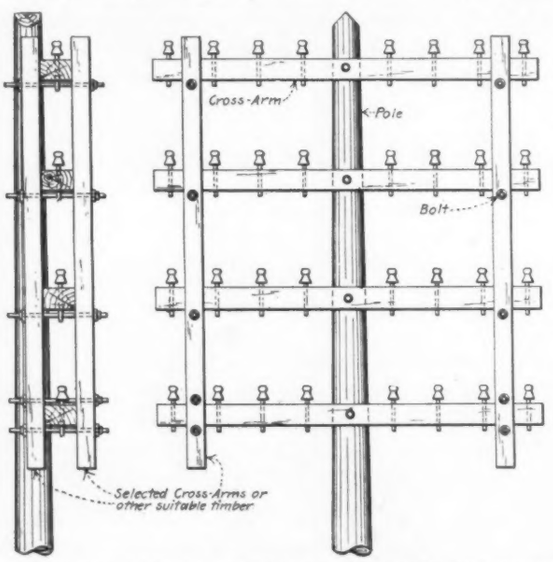
"Safety First" Electrical Warnings

Realizing the necessity of protecting the traveling public from every-day dangers that surround them, the New York Central Railroad has adopted an effective method of accomplishing its aim. About the depots where excursion crowds collect all electrical apparatus, wiring, switch boxes and the like bear the plain white legend "Safety first" upon a black background in clear-cut stenciled letters, warning away the person with over-curious tendencies without awakening within him the childlike desire to peer into whatever is labeled "Danger" or "Keep out."

The same methods have been extended and the "Safety first" signs are to be seen in conspicuous places near railroad crossings and in other locations where warning signs are necessary.

Temporary Cross-Arm Braces to Aid Construction Crews

Quantities of strong and vivid language are often wasted by the foremen of line gangs when they find that the cross-



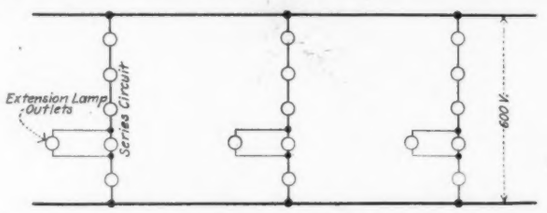
SCHEME FOR KEEPING CROSS-ARMS IN ALIGNMENT WHILE LINEMEN ARE WORKING

arms on a pole which has been used by the men for a "resting place" while pulling wires, splicing and testing are out of line when the job is finished. An Ohio foreman is saving much of his formerly wasted energy by resorting to the expedient shown in the accompanying illustration. A set of cross-arms of straight 2-in. by 4-in. pine timbers properly bored and fitted with bolts is carried as part of the construction equipment, and when it is necessary for several men to work on a pole for any considerable length of time the temporary braces are used to hold the arms in place. Ordinary 0.25-in. space bolts are found satisfactory for holding the braces to the arms.

In work of reconstruction where the old cross-arms and poles are rotted at the gains this brace is also useful.

Wiring for Extension Lamp in 600-Volt Series Circuit

The plans for the wiring of a new railway substation called for extension outlets so arranged that five lamps

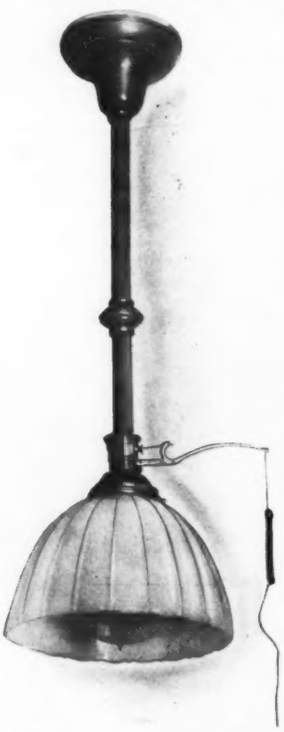


WIRING PLAN FOR EXTENSION LAMP IN 600-VOLT SERIES

would be in series across 600 volts, the fifth lamp being the portable extension outlet and the other four being stationary. The arrangement finally adopted was, therefore, to shunt duplicate outlets in parallel with the portable outlet of the regular series circuit. To operate an extension lamp at any point it is thus only necessary to plug into the desired receptacle, at the same time backing out or switching off the other lamp in multiple.

Tungsten-Lamp Fixture with "Hamstring" Switch

Frequent campaigns for new business are undertaken by the contract department of the Commonwealth Edison Company of Chicago. One to which particular attention is being devoted at the present time relates to tungsten-lamp fixtures for stores. The fixture selected is made by the Federal Sign System (Electric) and is illustrated herewith. It is used for individual 100-watt or 150-watt tungsten lamps and is provided with a "hamstring" switch attachment as shown in the illustration.



LAMP FIXTURE WITH "HAMSTRING" SWITCH

This fixture is sold outright by the electric-service company for $3, the Alba shade being $1.50 extra. However, the fixtures can be rented also, the rate being 50 cents each per month, with maintenance, provided not less than two fixtures are installed. This rental arrangement is made on a two-year contract, and after the expiration of this contract the fixtures may be rented at 25 cents a month each, provided not less than two are used. The energy needed for the operation of the lamp is charged for, in addition, at the regular lighting rate. The fixture is made of brush brass and presents an attractive appearance.

Construction Costs of Transmission Line Lowered by Use of Portable Concrete Mixer

With the increasing cost of high-grade wooden poles numerous expedients have been resorted to for preserving transmission-line poles at the ground line, and among the many methods which have been tried the scheme of concreting the poles to a distance of a foot or more above and

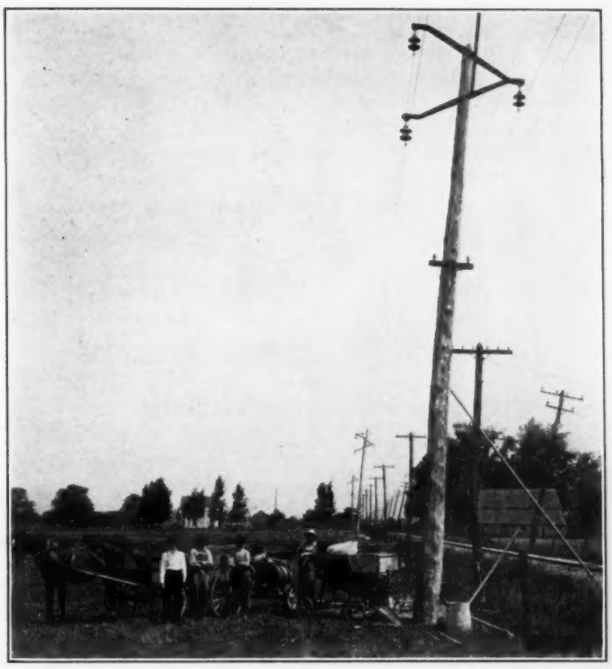


FIG. 1—CONSTRUCTION CREW WITH PORTABLE HAND-OPERATED CONCRETE MIXER

below the ground line has found considerable favor among the central stations. The cost of labor incidental to mixing the concrete for this type of reinforcement has in some cases been very high, and many schemes for reducing the cost have been tried with more or less success.

Fig. 1 shows a construction crew of the Marion Light &

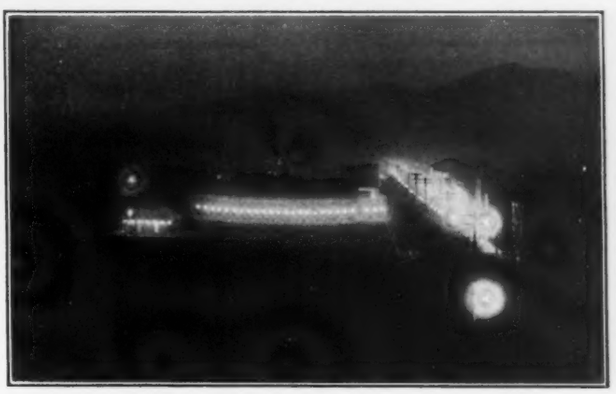
FIG. 2—CONCRETE IN PLACE AT GROUND LINE

Heating Company, of Marion, Ind., with the portable hand-operated concrete mixer which was used in setting the poles on one of the 35,000-volt transmission lines just out of that city. With this machine the ingredients for the concrete for one pole were dumped into the hopper, and when the crank was turned by one man the finished product was delivered directly to the hole from the mouth of the mixer. The poles on this line were large and heavy, with 8-in. tops, so that about 1.25 yd. of concrete was required for each hole. The span length was 350 ft., and as soon as the concrete had been mixed for one hole the apparatus was moved to the foot of the next pole along with the wagon which carried the supply of cement, gravel and water.

It is stated that the use of this concrete mixer in connection with the line construction saved approximately 50 per cent on the cost of concreting the butts of the poles.

"Booster" Illumination at Arlington, Wash.

"The livest electric town anywhere for its size, 2000 population," is the characterization given Arlington, Wash., a feature of whose night display is the use of strings of "booster" lamps along the center of the principal business streets. This lighting is paid for by the adjoining merchants, the installation having been promoted and installed by Mr. E. G. Robinson, manager of the Jim Creek Water, Light & Power Company, of Arlington. The central-station company has a quantity of surplus power rating which it makes use of in this way for boosting the town. Another feature of the display lighting of Arlington is the ingenious "arrow" sign described and illustrated in these columns. In this double-reading design the outlines are formed by



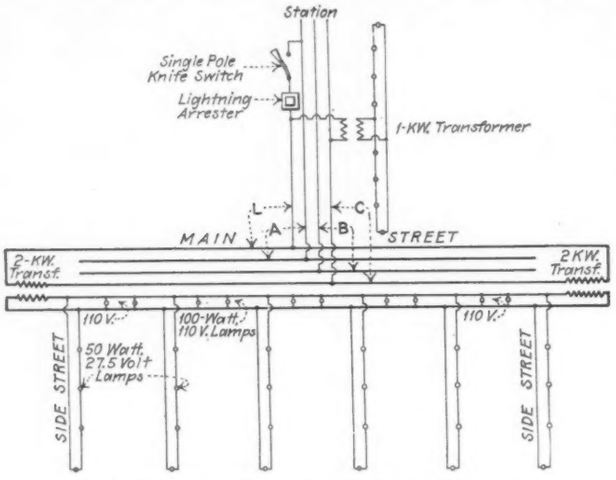
"BOOSTER" ILLUMINATION AT ARLINGTON, WASH.

the filaments themselves, the lamps being supported vertically from a distorted frame which brings the filaments into alignment. The illustration gives a bird's-eye view looking down the main street of Arlington, which is seen at the right; while at the left is the illuminated railway station and the row of lamps leading uptown. Attention of passengers on passing trains is also arrested by a large electric-lighted sign on the depot roof, "Trade in Arlington."

Tungsten Lighting Layout for a Small Town

Formerly the streets of Pincher Creek, Alberta (population, 1500), were lighted by sixty 32-cp, 110-volt carbon lamps. The simplest form of hood was used, and the lamps were wired in parallel with the house services, making it necessary to burn these street lamps all the time unless extinguished by patrolling. The Town Council finally desired to change this arrangement so that it might use 50-watt tungstens in place of the 32-cp carbons on the side streets and 100-watt tungstens on the main street. It was also desired to use the old hood as it was only possible to expend $1,000 on this work, but the insulation of the old hoods was too poor to permit using 2200-volt series construction. As the estimated cost of the change including control lines and new hoods for a series system was $3,000, the plan illustrated herewith had to be adopted.

A tap taken from phase *A* on the 2200-volt busbars was led through a single-pole knife switch in the power house and thence downtown to three step-down transformers having 110-volt secondaries. These transformers were placed at the points where needed, the other side of the primary windings being connected to phase *B* on the respective transformer poles. The 110-volt secondaries were then run



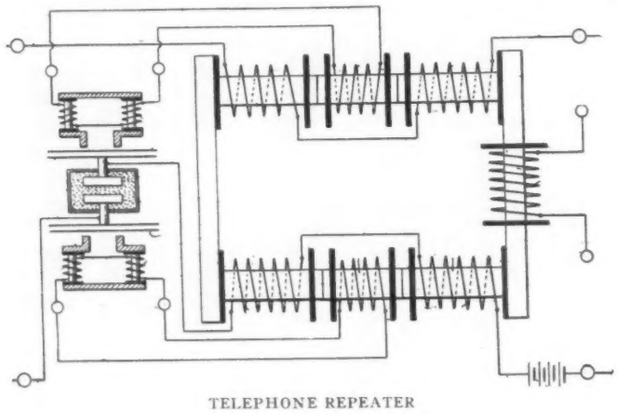
TUNGSTEN LIGHTING LAYOUT FOR A SMALL TOWN

down Main Street, feeding 110-volt, 100-watt multiple tungsten lamps connected in parallel every 100 yd. At each side street a tap was taken from these secondaries and run through four 27.5-volt, 50-watt tungstens wired in series and placed 150 yd. apart.

All of these lamps have since stood up very well in service and the 100-watt tungstens have averaged 3500 hours' life. The change, including seven miles of No. 8 wire, 100 lamps, three transformers and necessary insulators, brake-arms and cross-arms, cost about $600.

Recent Telephone Patents

In the accompanying illustration is shown a repeater which has been patented by Mr. D. H. Wilson, of New York City. The magnifying transmitter is directly in the main-line circuit, which in this case is led through the coils of the apparatus. A battery must also be included in the line circuit. An incoming undulation not only passes forward but



TELEPHONE REPEATER

induces a current in both middle coils which in turn affects their respective receiver parts so as to adjust the electrodes of the transmitter. This action causes the current to augment the original undulation. The coil shown at the right is merely an auxiliary listening-in coil.

Cords are dispensed with on the switchboard patented by Mr. A. Lawrence, of Elizabethtown, Ill. Behind each jack are pairs of contacts. All pairs of contacts in the same vertical plane are connected. Long plugs numbered in pairs reach through the jacks beyond the last set of contacts. Each pair of plugs is equipped to register with its own set of contacts so that two plugs of the same number register with the same plane of contacts and thus effect a connection.

Lock-out Systems

The lock-out party-line system patented by Mr. W. L. Campbell, of Chicago, is applied to automatic systems. It comprises a dial lock which prevents interference on a party line from any station not wanted.

Three patents issued to Mr. R. C. M. Hastings, of Columbus, Ohio, describe a lock-out system and special parts of the apparatus. The line is looped to all stations. The apparatus operates on a step-by-step system and centers around a key device which may be set for any station and which, after being actuated, carries out the necessary series of steps under the control of clockwork.

Letters to the Editors

A New Notion in Ventilation

To the Editors of the Electrical World:

Sirs:—In your issue dated Aug. 9, 1913, the ozone apparatus is highly commended by you as a means of removing the contamination in air due to respiration, thus doing away with unnecessary ventilation. However, users of this apparatus should be cautioned against using poor types or defective instruments, as a certain amount of atmospheric nitrogen may be fixed as oxides by them. These oxides are intensely irritating to the throat; and the last state of a man is worse than the first. It is a common saying among the workmen I have known around plants where nitrous fumes exist that "they always give you consumption if you breathe them much." Bacilli are necessary before this can happen, but I cannot imagine any worse predisposing influence than the action of the higher oxides of nitrogen on the mucous membrane.

Elizabeth, N. J. Donald M. Liddell.

The Metric System and Cables

To the Editors of the Electrical World:

Sirs:—Permit me to say a few words of qualified approval of Mr. Everett Morss' suggestion, in your issue dated Aug. 9, 1913, to express the electrical properties of wires and cables in terms of thousands of feet instead of miles.

Instead of "megohms per mile," it would indeed be better to say "megohms per thousand feet." However, "megohms per mile" is an inaccurate and misleading term, because, while the word "per" indicates division, the value of the so-called megohms per mile of a cable is less the greater the length in miles. For this reason I prefer the term "megohm-miles" to "megohms per mile."

A difficulty then arises with Mr. Morss' scheme, for if "megohms per mile" is replaced by "megohms per thousand feet," "megohm-miles" would have to be replaced by "megohms-1000 feet." This, being uneuphonious, may be replaced by thousand megohm-feet, abbreviated t.m.f. For example, a cable having an insulation resistance of 500 megohm-miles would have $500 \times 5.28 = 2640$ t.m.f.

It is unfortunate that our wire manufacturers and consumers have isolated themselves from the rest of the world by using peculiar units, such as the circular mil and the American wire gage. Is there any valid reason why we cannot have wires rated in square millimeters and their lengths in kilometers? The megohm-kilometer would be a really rational unit.

New York, N. Y. Wm. A. Del Mar.

CLIPPER AND SIDE GUIDE

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Accidents from Electrical Causes

It is a part of the duty of the Bureau of Electrical Inspection of the Department of Electricity of the city of Chicago to investigate the causes of electrical accidents. In the year 1912 216 accidents of this character were reported and investigated. Of these, 178 were to employees

ELECTRICAL ACCIDENTS IN CHICAGO IN 1912

Cause of Accidents	AGE		INJURY			VOLTAGE			Employees	Others
	Minor	Adult	Slight	Serious	Fatal	Low	High	Extra High		
Street-car accidents:										
Injured by controller flash	...	5	5	...	...	5	...	...	4	1
Blowing out of canopy switch	...	10	9	1	...	10	...	...	10	...
Blowing of fuse	...	10	8	2	...	10	...	...	9	1
Broken trolley wires	4	10	13	1	...	14	...	...	2	12
Shock or burned other than above	...	32	31	...	1	32	...	...	25	7
Short-circuit or flash:										
Operators	...	11	7	4	...	4	7	...	11	...
Electrician (inside)	...	24	21	3	...	24	...	...	24	...
Meter men	...	17	17	...	...	17	...	...	17	...
Cranemen	...	11	11	...	...	11	...	...	11	...
Linemen or repairmen	...	13	12	1	...	10	3	...	13	...
Others not electricians	...	14	12	2	...	14	...	...	13	1
Accidental contact:										
Repairmen (inside)	...	4	3	1	...	2	...	2	4	...
Electricians and station employees	1	2	2	1	...	3	...	...	3	...
Linemen and troublemen	...	15	6	5	4	...	15	...	15	...
Employees (not electrical)	...	8	6	...	2	7	...	1	8	...
Trespass, climbing arc lamp poles	3	1	...	4	...	...	4	...	...	4
Persons at work near live circuits	...	4	2	...	2	1	3	...	...	4
Broken wires	1	1	1	1	...	...	2	...	...	2
Defective wires	1	2	1	2	...	...	3	...	2	1
Accidental crossing of power wires with other wires	...	3	2	1	...	1	2	...	2	1
Breaking incandescent lamps	...	3	3	...	...	3	...	...	2	1
Miscellaneous	1	5	6	...	...	5	1	...	3	3
Total	11	205	178	29	9	173	40	3	178	38

of the owners of the apparatus and thirty-eight were to other persons. By far the greater portion of the accidents investigated were due to low-voltage circuits, the number being 173. The accidents resulted in death in nine cases, while there were twenty-nine reported as serious and 178 as slight. The accompanying summary gives an interesting tabulation of these electrical accidents.

Cost of Operating Evaporators in 20-Ton Ice Plant

If electrical energy can be sold at 0.875 cent per kw-hr. or less, a 20-ton electrically operated ice-making plant using multi-effect evaporators for producing distilled water can be operated at a rate to compete with a similar 20-ton steam-driven plant, according to data presented by Mr. T. N. Burch, of the Griscom-Russell Company, New York, before the Macon (Ga.) convention of the Southeastern Section, N. E. L. A. Under the same conditions a 100-ton ice plant can afford to purchase energy at 1.1 cents per kw-hr. and still compete with steam-driven ice factories.

With coal at $3 per short ton, the fuel cost of operating a 20-ton all-steam-driven plant would be $10.28 per day. To run a four-effect evaporator (requiring 1 lb. of steam, at 100 lb. pressure per sq. in., for each 3.5 lb. of distilled water produced) would cost but $2.68 per day. The evaporator system, declared Mr. Burch, is both simpler and less costly to operate than raw-water schemes requiring aeration of the freezing cans and withdrawal of successive core waters. Subtracting the cost of evaporator fuel from that required to operate an entire steam-driven plant, the remainder, $7.60, represents the limiting charge which may be made for electrical energy. Producing ice at an expenditure of 43.4 kw-hr. per ton, 868 kw-hr. will be required to freeze 20 tons, so that this energy must be purchased at a rate within 0.875 cent per kw-hr. The labor cost in the electric-evaporator plant will about equal that in a purely steam-driven plant.

For a 100-ton plant a rate as high as 1.1 cents per kw-hr. will similarly permit of competition with steam drive. In a certain 160-ton electrically driven ice factory the cost of manufacture per ton is divided up as follows: Fuel for evaporator, 12 cents; labor, 37 cents; electrical energy, 46 cents. The motor rating required averages 2.5 hp for each ton of ice-making capacity. The evaporators provided deliver 25 per cent excess of the needed quantity of distilled water.

A Runaway Waterwheel

A runaway turbine set caused serious damage in the Underwood (Ore.) plant of the Northwestern Electric Light Company, when one of the dam gates burst recently, and the normal speed of 360 r.p.m. was increased to about 1000 r.p.m. The revolving element weighed 41.5 tons and continued to run wild while the gate remained open. Reports estimate the damage at about $6,000, and declare that the machine became literally a ball of fire and that White Salmon Canon was lit up as by sunlight. Although burning projectiles were hurled about the turbine room, the engineer and his oiler stuck to their posts and finally succeeded in effecting a temporary closure of the gateway.

Methods of Spraying Oil Fuel

BY R. T. STROHM

The atomizing of liquid fuel, or the breaking up of the oil into a spray or mist, so as to enable the air to mix thoroughly with it, may be accomplished in a number of different ways. The most common method is that in which a current of steam or a blast of air is directed into or across the flow of the oil so as to divide it into fine particles. Another way is to subject the oil to a high pressure and then to allow it to escape through small orifices. These orifices are so shaped and placed that the escaping oil is expanded, scatttered and properly atomized. A third method involves the use of centrifugal force. A whirling motion is given to the oil, and the centrifugal force set up causes the oil particles to fly off in the form of spray.

The principles involved in all of these methods are used in modern liquid-fuel burners, but centrifugal force alone is not relied upon to produce the desired atomization. In the lengthy and exhaustive tests made by the Bureau of Steam Engineering of the United States Navy several attempts were made to use an atomizer consisting of a steel disk that was rotated at a high speed and over which the

GRIPPER AND SIDE GUIDE

oil was allowed to flow. The earlier constructions warped under the effect of the heat or were wrecked by the centrifugal force developed, but by altering the construction in accordance with the experience gained from these initial experiments a centrifugal apparatus was eventually produced.

It consisted of a circular disk of saw steel riveted to a

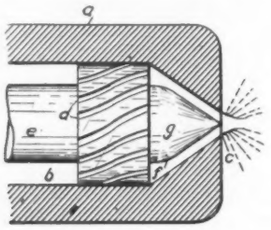


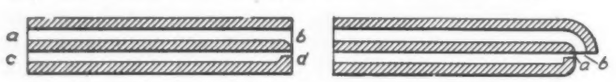
FIG. 1—CENTRIFUGAL TYPE OF ATOMIZER

hollow pivot that was held solidly in vertical bearings. Buckets or vanes were attached in a circle to the under side of the disk, and a jet of steam from a single nozzle was directed on this series of vanes, thus rotating the disk at a high speed. The oil to be sprayed was forced up through the hollow pivot under a small pressure and overflowed on to the disk at the center. Under the action of the centrifugal force set up by the very rapid rotation, it was flung off at the outer edge, and when ignited by a torch it burned in a ring of flame from 4 ft. to 5 ft. in diameter.

In spite of the fact that a mechanical rotary atomizer had thus been developed, this type has not been adopted in commercial installations using oil fuel. The reason is that the spraying force is derived from the jet of steam, and it is simpler to use the steam directly for spraying, without the introduction of the rotating disk. Also, it is probable, from the results of the experiments referred to, that trouble would arise through warping of the disk and wearing of the pivot. It is true that the flow of the oil across the face of the disk has a tendency to cool it somewhat and thus reduce the warping effect, but the fact remains that the purely centrifugal sprayer has not met with favor.

In connection with pressure spraying from an orifice, however, the centrifugal principle has been used successfully. This combination may be illustrated by the simple sketch shown in Fig. 1. At the end of the pipe *a* that conveys the oil, the oil passage *b* is tapered down to the opening *c* through which the oil is discharged. The series of slanting vanes *d* on the rod *e* deflect the oil and break it up into a number of currents, each of which has a whirling motion as it enters the space *f* around the end *g* of the rod. These separate currents are intermingled in the space *f*, and on emerging from the orifice *c* they spread as shown by the diverging lines. The oil is forced into the pipe *a* under fairly high pressure, and thus the atomizing is due both to the twisting motion given by the vanes and the expansion following the escape at high velocity from the orifice.

Though the principle just described could be applied in any installation, it would doubtless be most advantageous in



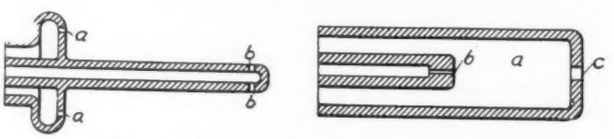
FIGS. 2 AND 3—COMMON FORMS OF OUTSIDE MIXING BURNERS

the case of a plant in a district where suitable water is scarce or hard to obtain. For the steam that is used to atomize the oil by direct action goes along with the products of combustion and escapes at the top of the chimney. It is thus lost absolutely, so far as the chances of recovering it are concerned; whereas by using a device similar to that shown in Fig. 1 there is no waste of steam. It is true that steam would be required to run the pressure pumps, but it could afterward be led to some form of condenser and thus recovered for boiler-feed water.

A disadvantage of the system of spraying oil by pressure lies in the fact that the openings through which the oil is forced must not be much greater than 1/16 in. in diameter. An opening of this small size can very easily become clogged by a bit of dirt or a grain of sand; therefore a strainer should always be inserted in the oil system. The holes in the strainer, of course, must be small enough to catch and retain all dirt of sufficient size to clog the burner. Usually they are made about half the size of the hole or holes through which the oil is sprayed.

By far the greater number of oil-fuel plants use steam or air as the atomizing agent. If steam is used, it is obtained from the boiler being fired or from another boiler in the plant, and if air is used, it is obtained by means of a positive blower or an air compressor. No matter which agent is used, it is led in a sheet or a jet against the oil to be atomized. The mixing of the oil and the steam or the air may take place inside the atomizing device or outside it, but in either case the spraying is due to the expansion that occurs when the steam or air under pressure escapes from the orifice and mingles with the oil.

The device that accomplishes the atomization of the oil is called the burner, though it has nothing to do directly with the combustion. There are two main classes of burners, namely, outside mixers and inside mixers. A common form of outside mixing burner is shown diagrammatically in Fig. 2. The oil to be atomized is led through the passage *a* and is allowed to flow out and down at the orifice *b*. The steam or air is conducted through the passage *c* and



FIGS. 4 AND 5—PROJECTOR BURNER AND INSIDE MIXING BURNER

allowed to escape through the narrow orifice *d* just below the oil orifice. The oil that oozes or drools out is thus caught by the rapidly escaping and expanding steam or air and is thoroughly sprayed. This type is ordinarily termed the drooling burner.

Another form of outside mixing burner is shown in Fig. 3. It differs from the other only in that the oil passage is turned downward at the outlet end, and the steam or air issuing from the orifice *a* sweeps directly across the face of the oil orifice *b*. This type is called the atomizer burner.

The type shown in Fig. 4 is called the projector burner and also belongs to the outside mixing class. In this case, however, the orifices *a* through which the steam or air escapes are at some distance from the oil orifices *b*, so that the steam or air has expanded considerably by the time it meets the oil.

One form of inside mixing burner is shown in Fig. 5. The oil flows into the chamber *a* surrounding the nozzle *b* through which the steam or air is led, and the latter meets and mingles with the oil in the chamber, after which both are discharged at *c*. This form of burner is termed a chamber burner.

The diagram in Fig. 6 illustrates the principle of the injector burner. The steam or air flows from the orifice *a* into the passage *b* containing the oil, and the mixture is carried forward with increasing velocity toward the narrowest part *c* of the burner. Beyond this throat the mouth is flared, and the rapid expansion atomizes the oil.

The various types of burners employed in steam plants involve the use of one or more of the foregoing principles. Air is used only in special instances as the atomizing agent, steam being the most common. So far as economy is con-

cerned, there is little to choose between the two, for the reason that the amount of steam required for direct atomizing is about the same as that required to run an air compressor to furnish a sufficient supply of air at the necessary pressure. On the other hand, the addition of a compressor means increased cost for installation over that for a plant using steam directly; also, the amount of

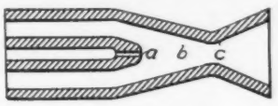


FIG. 6—SKETCH SHOWING PRINCIPLE OF INJECTOR BURNER

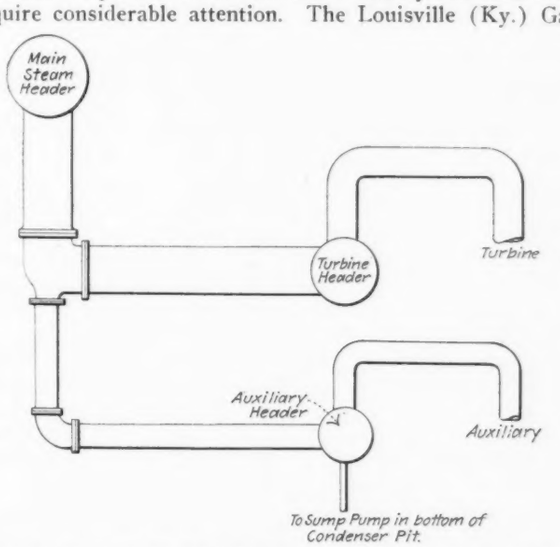
piping and apparatus is increased by the use of a compressor, with the natural result that accidents are more likely to happen and so cause partial or complete shut-downs.

The amount of steam used to atomize 1 lb. of oil, whether directly or indirectly, may be taken as about 0.5 lb. for average cases. There are plants in which only about 0.3 lb. of steam per pound of oil is used for atomization, and in the tests made by the Bureau of Steam Engineering some burners used as low as 0.15 lb. of steam per pound of oil. This last was an exceptionally good performance and was unusual. The average plant may consider that its economy is fair if its steam consumption for atomization only amounts to from 0.3 lb. to 0.5 lb. per lb. of oil.

In addition to the steam required for atomizing the oil, there is the steam required for running the pumps by which the oil is supplied under pressure and the steam used in some cases for heating the oil. The amount of steam used for atomization is roughly 2 per cent of the total amount generated by the boiler; that is, out of every 100 lb. of steam formed, 2 lb. are taken to spray the oil. The oil-pressure pumps and the oil heater require about 2 per cent more, so that the total steam consumption of the oil system is in the neighborhood of 4 per cent of the steam generated.

Arrangement of Headers to Eliminate Steam Traps

Steam traps are often sources of annoyance and may require considerable attention. The Louisville (Ky.) Gas



ARRANGEMENT OF HEADERS TO ELIMINATE STEAM TRAPS

& Electric Company avoids their use in its Waterside station by the construction illustrated herewith. This station contains six Babcock & Wilcox boilers, each of which is capable of supplying 35,000 lb. of steam per hour. The pressure maintained is 200 lb. per sq. in., with a superheat of about 125 deg. Fahr. furnished by superheaters having 5087 sq. ft. of surface installed in each boiler.

Steam traps are eliminated by using three steam headers placed horizontally one above the other and connected by drop pipes which drain the condensate to a point where it is disposed of without damage to machinery. One of the lines is the main steam header and the other two are the turbine and auxiliary headers respectively.

From the lower part of the auxiliary header two pipes are led to pumps which circulate the water supplied to the plant turbine condensers. Below the steam connections to the circulating pumps pipes are connected feeding steam to the slow-speed reciprocating sump pumps located in the bottom of the condenser pit about 53 ft. below the level of the engine-room floor. By this method of systematic draining the condensate is disposed of without the use of steam traps. The water which eventually reaches the sump pumps can do no damage to the slow-speed engines and is disposed of through their exhaust.

Effect of Power-Factor on Automatic Starters

Will a change in the power-factor of a circuit have any effect on the automatic starters used with elevator motors? G. G. S.

No. The strength of the solenoids is affected only by a change in ampere turns, so that as long as the current remains the same their operation is not hampered by change in power-factor.

Use for Scrap Carbon Electrodes

We have quite a quantity of broken pieces of carbon from arc lamp electrodes. Can any use be made of them? F. A.

The pieces may be made into electrodes of standard size by grinding them to fit and joining them under pressure by means of a mixture of water glass and powdered cargon. The resistance of the electrode will be slightly greater than one not so jointed, and the joint will be stronger than the rest of the electrode.

Location of Watt-Hour Meters on Switchboards

Where should watt-hour meters on large power-house switchboards be placed, on the front or on the back of the board? There seems to be no established practice in this respect. C. A. C.

Unless there are very good reasons for placing watt-hour meters on the front of a switchboard, they should always be placed on the rear. A switchboard attendant in a large station should have before him only such instruments and apparatus as he must necessarily use in the operation of the system. All others should be placed elsewhere.

Fusing Currents for Copper Wire

Are reliable tables available showing the current strengths required to fuse copper wire? It sometimes happens that regular alloy fuse wire cannot be had quickly when motors or other circuits have blown their protective links. To restore service temporarily it would be useful to know what sizes of copper wire might be employed with safety to the circuit. L. M. K.

The following table has been tested for copper-wire fusing currents and was found to be closely correct for average conditions:

Size Wire, B. & S.	Fusing Current, Amp.	Size Wire, B. & S.	Fusing Current, Amp.
30	10	18	80
28	15	17	100
26	20	16	120
25	25	15	140
24	30	14	160
22	40	13	200
21	50	12	240
20	60	11	280
19	70	10	330

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Definition of Alternating-Current Terms.—The committee on units and notation of the German Association of Electrical Engineers publishes a report, signed by Strecker, in which the following definitions are recommended. If I is the effective current, E the effective voltage between two points, and L the power consumed between these points, then the following names are proposed: L/E, Werkstrom (work-current); $\sqrt{I^2-(L/E)^2}$, Blindstrom (blind current); L/I, Werkspannung (work voltage); $\sqrt{E^2-(L/I)^2}$, Blindspannung (blind voltage); EI, Scheinleistung (apparent power); L, Leistung (power); $\sqrt{(EI)^2-L^2}$, Blindleistung (blind power); E/I, Scheinwiderstand (apparent resistance); L/I^2, Werkwiderstand (work resistance); $\sqrt{(E/I)^2-(L/I^2)^2}$, Blindwiderstand (blind resistance); I/E, Scheinleitwert (apparent conductance); L/E^2, Werkleitwert (work conductance); $\sqrt{(I/E)^2-(L/E^2)^2}$, Blindleitwert (blind conductance); $L/(EI)$, Leistungsfaktor (power-factor). The resistance measured with direct-current is called Gleichwiderstand (direct resistance). The resistance which when multiplied with the time and the square of the current gives the Joulean heat is called Echtwiderstand (real resistance). Explanatory notes of these definitions are added by J. Teichmueller and R. Richter.—*Elek. Zeit.*, Aug. 14, 1913.

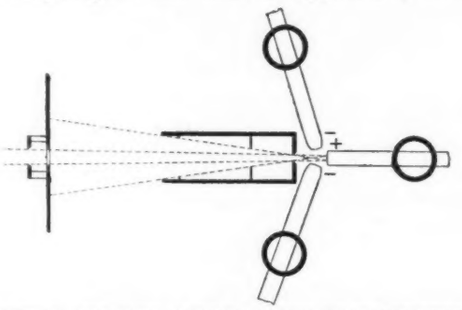
Single-Phase Commutator Machines.—Johann Lissner.—The author first explains in what respects his method of mathematically investigating single-phase commutator machines differs from other methods for this purpose. He then applies his method to calculate several special problems. His method leads to simple results for the series motor, while the theory of the repulsion motor and of the separately excited motor becomes more complicated. Although problems of single-phase commutator machines cannot be treated as simply as those of machines without commutators, the author's method permits the necessary number of simultaneous linear differential equations to be ascertained quickly and their integration offers no difficulties, although the results obtained are only in very special cases sufficiently simple.—*Elek. u. Masch.* (Vienna), July 13 and 20, 1913.

Speed Regulation of Induction Motors.—F. W. Meyer.—An article illustrated by diagrams, discussing in a simple way the fundamental principles of the methods of speed regulation of large induction motors with the aid of small auxiliary commutator motors. The author shows that in such systems it is easy to combine speed regulation with a compensation arrangement to obtain a high power-factor in a simple way without complications.—*Elek. Zeit.*, Aug. 7 and 14, 1913.

Transformers.—W. M. Dann.—An illustrated article on 150,000-volt power transformers with special reference to the installation of the Pacific Light & Power Corporation.—*Elec. Journal*, August, 1913.

Lamps and Lighting

Electric Arc as Standard of Light.—J. F. Forrest.—A number of methods are described by which it was sought to obtain a workable standard of light from the electric arc, using carbon electrodes. Among these may be mentioned concentric carbons. Satisfactory results were finally obtained by using two negatives and one positive. This gives an arrangement which is easily controlled and easily reproduced. The three electrodes are set in a horizontal plane, each negative making an angle of 100 deg. to the single positive. Each negative has its own series resistance so that when current is flowing there proceed from the end of the positive electrodes two distinct stable arcs. The underlying idea of this arrangement was to force as much current as possible through the end of positive electrode without causing hissing, so as to cause the bright quadrant shown to spread over the whole surface. It is possible to work with current densities as high as 0.4 amp per square millimeter of cross-section of the positive carbon. As far as experiments go at present, the two steadying resistances must be kept entirely separate, as if the combined current of the two arcs traverses any resistance the currents rapidly assume an unstable equilibrium. A nickel diaphragm, 1 mm thick, is supported by an adjustable tube at a distance of 15 mm from the crater, the hole in the diaphragm being about 1 mm in diameter. Two stops inserted in the tube cut off reflected light, and the light from the crater is thrown onto a white screen about 15 cm from the arc. A hole in this screen passes a beam of light of sufficient dimensions to cover the photometric screen. The edges of this hole are specially guarded against reflection by the small stop placed immediately after it. The angle of the carbons was obtained experimentally and is that giving at once the steadiest arcs and the best view of the crater. The edges of the hole in the diaphragm turned toward the arc were beveled, the beveling forming protection against the flame should the arc accidentally sweep across the face of the diaphragm. These diaphragms were found to be useless, owing to the fact that they buckled and were easily burned through. Solid carbons of equal size in all three places were used, the unsteadiness caused by particles of the cores of cored carbons falling out being found to be very disturbing. Details are given of the arrangements and results obtained.—London *Electrician*, Aug. 8, 1913.



SKETCH SHOWING ARRANGEMENT OF ELECTRODES

Street Lighting with Tungsten Lamps.—G. H. Stickney.—An illustrated article on city-street lighting with series tungsten lamps. Diagrams are given of the variation of candle-power during the life of tungsten series and carbon series lamps, also curves showing the net yearly income to central stations from operating tungsten series lamps and the saving effected by substituting tungsten for carbon lamps. Typical photometric curves of tungsten lamps are also given.—*Gen. Elec. Review*, September, 1913.

British Gas-Electric and By-Product Recovery Plant.—An illustrated article on the Accrington Electricity Works in England, which are working in conjunction with a gas-producer and by-product recovery plant. There are two 1250-hp. Mond pressure producers running on bituminous coal, which costs $3.37 per ton. Sulphate of ammonia and tar are recovered. There are two 1000-hp gas engines driving alternators each generating three-phase currents at 6000 volts to 6600 volts. This plant is linked up to the older high-speed direct-current steam plant through three motor-generators which permit the economical distribution of the load between the steam and the gas plant. In the gas plant the fuel consumption is a little more than 1½ lb. per kw-hr. and costs about 0.25 cent, and against this there is to be credited from the sale of by-products 0.14 cent, leaving a fuel cost of 0.11 cent per kw-hr. generated.—London *Elec. Review,* Aug. 15, 1913.

Waste Heat for Electricity Generation.—An illustrated article on the West Hartlepool central station, which is the first municipal station in Great Britain to adopt the system of generating electricity from waste steam obtained from outside sources. The station receives exhaust steam from the Seaton Carew Iron Company and in exchange supplies, free of charge, to this company a certain amount of electrical energy. The present steam requirements of the plant, however, are supplied from the exhaust steam from six blowing engines, which in turn are supplied with steam at 80 lb. to 100 lb. pressure from a battery of sixteen gas-fired boilers, evaporating 200,000 gal. of water per day. There are two steam-turbine-driven three-phase alternators, each of 1250 kva.—London *Elec. Review,* Aug. 1, 1913.

Cooling Gas Engines.—BERTRAM HOPKINSON.—A paper in abstract read before the (British) Institution of Mechanical Engineers. A description is given of a method of cooling gas engines by injecting water into the cylinder in the form of a coarse spray. The advantages of this arrangement are discussed, and the results on some tests made on an engine fitted in this way are given.—London *Electrician,* Aug. 8, 1913.

Traction

Berlin.—An article, illustrated by maps, on extensions of the Berlin elevated railroad and subway from Spittelmarkt to Alexanderplatz and Schoenhauser Allee.—*Elek. Zeit.,* Aug. 7, 1913.

Installations, Systems and Appliances

Electrical Industries in Italy.—While the general industrial condition of Italy has recently been unfavorable, the Italian electrical industries have stood the crisis better than any other industry. There are various large water-power plants in course of development. Congress has granted funds to aid in the development of the Tila water-power system. There will be four large storage reservoirs, and when completed there will be available 150,000 hp in three falls, of together 1000 m. Notes are given on some railway lines to be electrified. A table is given showing the financial results of the twenty-nine most important companies supplying electrical energy in Italy. Sixteen of these have paid the same dividend as last year, ten have increased their dividend and three have reduced it. The average dividend has increased from 6 per cent to 6.3 per cent. Only two companies have passed their dividends, against three last year.—*Elek. Zeit.,* Aug. 7, 1913.

European Versus American Practice in Lightning Arresters.—E. E. F. CREIGHTON.—Nearly all the usual features of European practice in lightning arresters are embodied in a 15,200-volt Mexican installation, which, for the sake of a definite basis for comparison with American practice, was selected by the author for discussion. In the first section of the paper formerly published a comparison was made between the space occupied by the European arrester and its equivalent in American apparatus, showing a ratio of something like ten to one to the credit of the latter. The American equipment was also shown to possess the advantage of lower cost as regards installation, operation and maintenance. European practice is divided into six distinct sections, five of which are found in the Mexican installation. All six are fully discussed—one in the first part of the article and the rest in the present instalment. Of the lot, there seems to be no justification, theoretical or practical, for the employment of two of these arrangements. The remaining four, while possessing advantages under certain circumstances, are more prone to trouble-making than the aluminum arrester and do not provide adequate protection in the same high average number of cases.—*Gen. Elec. Review,* September, 1913.

Oil Switches.—A. SIMON.—A note on what occurs when the contact of an oil switch is broken. The author claims that the oil itself does not extinguish directly the arc by its cooling effect, but that the arc is extinguished by the gas formed by evaporation of the oil. On account of the inertia of the surrounding oil, this gas is under a comparatively high pressure.—*Elek. u. Masch* (Vienna), Aug. 10, 1913.

Current Distribution in Busbars.—W. O. SCHUMANN.—A mathematical paper on the distribution of alternating current in two infinite parallel plates. The effective resistance and the "internal" self-inductance are determined. The author finally estimates how far his results may be used for the case of copper bars of finite dimensions.—*Elek. u. Masch.* (Vienna), July 27 and Aug. 3, 1913.

Switchboard Relays.—D. BASCH.—The third article of his serial on the application of switchboard relays to the protection of power systems. In the present instalment the author deals with line short-circuits.—*Gen. Elec. Review,* September, 1913.

Switchboards.—C. H. SANDERSON.—In a sixth article of his serial on switchboards for alternating-current power stations the author discusses electrically operated switchboards.—*Elec. Journal,* August, 1913.

Wires, Wiring and Conduits

Electrical Contractors.—An account of the eleventh annual meeting of the German Association of Electrical Contractors. Ely read a paper on the relation of central stations to wiring contractors. A report was presented on co-operation with the Association of German Central Stations. The present great tendency to sell or rent municipal stations to private companies was discussed. Other objects of discussion were monopoly tendencies in the electrical industry, organization problems, etc.—*Elek. Zeit.,* Aug. 7, 1913.

Bakelite Micarta.—R. W. E. MOORE.—An illustrated article on the characteristic thermal, electrical, chemical and physical properties of bakelite micarta and its applications for brush-holder tubes, collector insulation, etc.—*Elec. Journal,* July, 1913.

Electrophysics and Magnetism

Experimental Proof that the Electric Current in Metals Is Best Carried by Electrons.—O. W. RICHARDSON.—The idea has recently become rather prevalent that the emission of electrons from hot bodies is a secondary effect arising in some way from traces of chemical action. The author's experiments with tungsten filaments do not confirm this view. The author has made a series of experiments to test the various possibilities of the origin of the electronic emission from tungsten at high temperatures. His experiments prove that the emission of electrons does not arise from any interaction between the hot filament and surrounding gases or vapors nor from any process involving consumption of the material of the filament. It thus follows that the emission of electrons from hot tungsten, which there is no reason for not regarding as exhibiting this phenomenon in a typical form, is not a chemical but a physical process. This conclusion does not exclude the possibility that, under other circumstances, electrons may be emitted from metals under the influence of various chemical reagents. The

author's experiments "also show that the electrons are not created either out of the tungsten or out of the surrounding gas. It follows that they flow into the tungsten from outside points of the circuit. The experiments therefore furnish a direct experimental proof of the electron theory of conduction in metals."—*Philos. Magazine,* August, 1913.

Electric Contact Resistance.—F. W. Harris.—An article in which the author formulates the following laws of contact resistances: All other conditions being constant, the voltage across a contact joint will increase directly with the current; or the joint between two materials behaves exactly like a resistance. When the conditions of the surface in contact are not affected thereby, the voltage across a contact will vary inversely with the pressure. The resistance between materials depends directly on the internal resistance of the materials, those having a low resistance having also a low contact resistance. The resistance between contacts depends not upon their area but only on the total pressure with which they are forced together.—*Elec. Journal,* July, 1913.

Electrochemistry and Batteries

Electrolytic Production of Caustic and Chlorine.—J. B. C. Kershaw.—An illustrated article on the Billiter-Siemens electrolytic cell and process, with a brief description of two plants in Germany and in Bohemia where this cell is in use. —London *Elec. Review,* Aug. 15, 1913.

Units, Measurements, and Instruments

Total Radiation Pyrometers.—G. K. Burgess and P. D. Foot.—An abstract of an American Physical Society paper. Although the relation between the energy J emitted by a black body and its temperature T follows the law $J = \sigma T^4$, since the fraction absorbed by the radiation pyrometer is in general not a constant factor for all temperatures but rather of the form $f(T)$ there is for this type of pyrometer an equation which does not necessarily follow the fourth-power law but has the form of $E = aT^b$, where E is the electromotive force generated by the thermo-element, and a and b certain empirical constants, b varying from 3.5 to 4.2 with the seventeen instruments tested. The emf indicated by several Féry total radiation pyrometers showed a marked lag effect due to a slow heating of the couple. Frequently as long an exposure as ten minutes is required before the maximum reading is attained. In other cases the time lag was less than twenty seconds. After the maximum reading was shown, the emf for several instruments dropped by an equivalent of 10 deg. C. during the first ten minutes, when sighted as a furnace at 1300 deg. C., while other instruments maintained a constant value. This drop is due to the conduction of heat from the hot to the cold junction of the thermo-element and can be easily minimized by increasing this distance. Preliminary measurements upon the total emissivity of various substances met with in industrial work have shown that the equation $E = b(\log S - \log T)$ is applicable where E is the total emissivity, b the exponent for the particular radiation pyrometer used, S the apparent temperature and T the true temperature absolute. Using this relation, E for iron oxide was found to be 0.86, for nickel oxide 0.83. A slight indication of a temperature variation of emissivity was found, E increasing with temperature, but the variation was almost within the limit of errors of observation.—*Phys. Review,* July, 1913.

Rheostat.—H. H. Broughton.—An illustrated description of an inexpensive loading rheostat, built up on the interchangeable unit system, of simple and sound mechanical construction, for use in test rooms and engineering laboratories is described. The units are made of Eureka wire in frames of standard sizes so as to dissipate 750 watts (3 amp at 250 volts). Details and illustrations are given of the construction.—London *Electrician,* Aug. 15, 1913.

Telegraphy, Telephony and Signals

Wireless Telegraphy.—J. J. C. Mueller and J. R. Grall. —An illustrated description of a transmitting and receiving station for wireless telegraphy with damped oscillations for demonstration purposes in schools.—*Elek. Zeit.,* July 10, 1913.

Miscellaneous

Legal Knowledge Essential to Engineers.—W. A. J. O'Meara.—An abstract of a lecture held before the students of Faraday House. The author discusses those points in the law of torts and contracts which are likely to be met with by the engineer in the course of his practice. Some notes on the discharge of contracts and the way in which they should be constructed are also given.—London *Electrician,* Aug. 15, 1913.

Book Review

The Motor and the Dynamo. By James Loring Arnold, Ph. D., professor of electrical engineering, New York University. 178 pages, 166 illus. Price, $1.50. Easton, Pa.: The Chemical Publishing Company.

This book is not only concerned with the principles underlying the design and operation of dynamo-electric machinery, but it is also descriptive of machines and auxiliary apparatus. The illustrations are numerous and, on the whole, clear and instructive. The language and exposition are generally simple and clear. Both are the outcome of a mind accustomed to mathematical thinking, although the mathematics used is not of high order; the calculus—assumed by common assent to be difficult of understanding—makes its appearance only at rare intervals. The author makes no claim to originality in the presentation of his subject—or subjects. He says what he has to say without preamble, clearly, concisely, almost breathlessly. Herein seem to lie the originality and peculiar fascination of the book. It is so utterly without superfluous matter, so direct, and has withal a pace so rapid that it carries one forward with the same disregard of personal comfort as the most exciting detective story. The atmosphere of undue haste is accentuated by the occasional—although by no means serious—typographical errors that have remained undetected by the proofreaders, and by the still rarer occurrence of unsuitable words hurriedly chosen. An instance occurs on page 86, where the speed control of "constant-speed motors" is seriously discussed. The introduction (Chapter I) plunges the reader in the discoveries of Oersted and the underlying principles of all dynamo-electric machinery. It covers three pages of the book. Chapter II, which fills eight pages, deals with the mathematical principles of electromagnetic phenomena. As we proceed, the practical interest increases, but the principles, and the explanations of the reasons of things, are never overlooked. The book is consistent—lucid, terse and time-saving. On page 169 the reader is introduced to the alternating-current series motor; the two following pages contain characteristic curves of direct-current and alternating-current motors respectively, and page 172 is blank. We realize that the end has been reached with a precipitate abruptness entirely in keeping with the introductory paragraphs. In the preface the author states that the book is the result of many years' experience in presenting "the essentials of electrical science" to college students and practical engineers, and that he "hopes that the book may be found practical and direct and sufficiently exhaustive to both college men and electricians." It is probable that the calculus and the photographs of machines have been introduced for the edification of the college students, and the simple explanations and diagrams for the instruction of operating engineers in charge of machinery. The book may have a large circulation, which it seems to deserve, but it is not easy to call to mind the particular type of man who will find in this book not only the facts but the inspiration and food for thought which he fails to find in other books dealing with the various phases of the same subject.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Pot-Type Electric Coffee Percolator

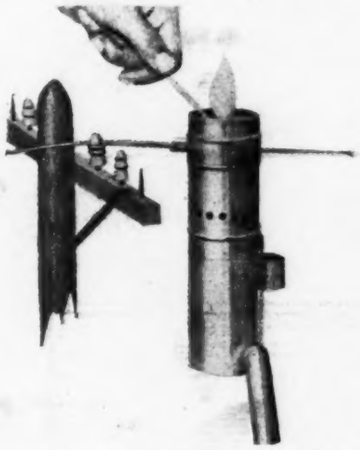
A percolator which is more economical than the elaborate styles is being introduced by the Westinghouse Electric & Manufacturing Company. All metal parts are heavily tinned inside and nickel-plated outside. The heater is of a special design, projecting from the bottom of the vessel into the water. If always operated immersed in water,

POT-TYPE ELECTRIC COFFEE PERCOLATOR

the heater, it is stated, will last a lifetime, but if for any reason repairs are needed, new heaters can be easily installed. Connections from the heater are made to suitable terminals carried in the base of the percolator. A 6-ft. silk-covered cord complete with detachable nickel-plated receptacle and attachment plug is furnished with each percolator. The coffee retainer being made of German silver guarantees it against chemical action and corrosion. This percolator consumes 380 watts and has a capacity of 2.5 pints of coffee.

Lineman's Torch for Soldering Connections

A lineman's torch has recently been brought out by Mathias Klein & Sons, of 562 West Van Buren Street,



LINEMAN'S TORCH FOR SOLDERING

Chicago, Ill. The torch is small and light in weight and can be carried by a lineman in his belt. It is said to burn without odor or noise, and the flame will not be extinguished in the wind while the wind shield is in place.

In use the torch is suspended upon the wire beneath the connection to be soldered by placing the wire in the slot in the upper rim and giving the body of the torch a half turn to the right. A half turn to the left when the connection is finished removes the torch from the wire. The device has the further advantage that it can be lighted or extinguished almost momentarily as it is needed. A cup for holding soldering paste is provided with the torch.

Improved Vacuum Cleaner

The National Stamping & Electric Works, of Chicago, have brought out an electric vacuum cleaner bearing the name "Red Ring." Small rollers connected to the base in the manner indicated in the accompanying illustration permit the device to stand alone in an upright position. For cleaning under beds and other furniture, however, the apparatus can be dropped to an 8-in. clearance. A universal 1/6 hp motor, operating at 110 or 220 volts, is used. This drives a small fan and the weight of the cleaner with-

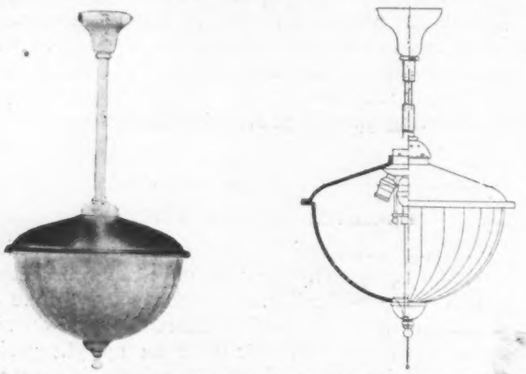
VACUUM CLEANER

out attachments is said to be only 9 lb. The body of the device and of all the tools and attachments is made of hard fiber, not apt to injure polished floors, floor coverings or furniture. The manufacturer says that the machine has a displacement of over 100 cu. ft. of air a minute. It cleans a strip 11 in. wide. The fan pulls the dust and dirt down into the bag from the top and not up from the bottom. The suction is from the nozzle through tubing to the top of a cylindrical housing and into it through an opening. A little window at the top of this housing enables the operator to see the entrance of the dust and to know whether the machine is operating constantly. The handle of the machine contains a suction pipe. By manipulating a valve

the machine is ready for cleaning walls, stairs, radiators, etc. The dust and dirt are all arrested by the dust fabric without passing through the fan. It is thus declared that no fan trouble can occur with the Red Ring cleaner, as the fan handles nothing but air.

Dust-Proof Lighting Unit for Hospitals

A lighting unit especially designed for hospital service has been brought out by the Lighting Studios Company, New York City. The fixture is of the semi-indirect type, the lower bowl being of Doric moonstone glass. The



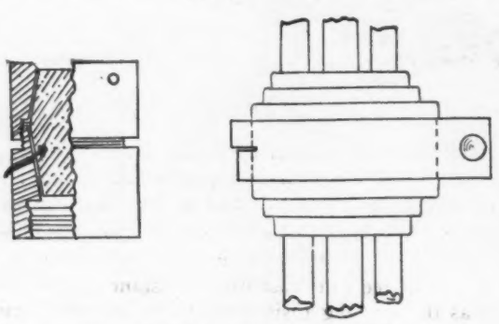
EXTERIOR AND SECTION OF DUST-PROOF LIGHTING UNIT

interior of the unit is protected from dust by an inclosing covering of transparent glass. The unit is provided with a three-way electrolier pull switch wired so that one, two or three lamps may be operated in the bowl or all may be turned off. The stem and other parts are of plain design finished in white enamel.

Cable Supports and Sleeves

The feeder support which is shown in Fig. 1 consists of a block of lignum vitæ bored to admit one, two or three cables, the block being finished on the outside with oppositely inclined faces. When the outer pieces shown in the illustration are screwed down upon the block the sawed openings in the circumference which lead to each of the three holes close up on the cables and hold them securely in place. By this method the weight of the cables is transferred to the conduit, which in turn may be secured to the building at suitable places. This device is regularly made in four stock sizes and can be installed on any conduit ranging from 1.25 in. to 3.5 in. in diameter.

The illustration Fig. 2 shows another type of feeder support which may be slipped on the cables after they have



FIGS. 1 AND 2—FEEDER SUPPORTS

been installed. The blocks of lignum vitæ in this case are held together by a two-part metal clip. This device can be used on conduit varying in size from 1.5 in. to 3.5 in. in diameter.

The appliance shown in Fig. 3 has been made to supplant the sheet-iron box used as a pull box and consists of two cast-iron telescoping shells. The upper section rests upon an ordinary bushing and the lower one upon a feeder

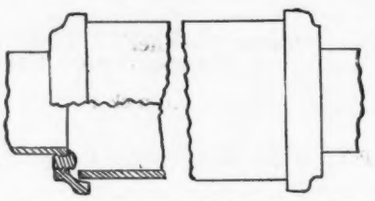


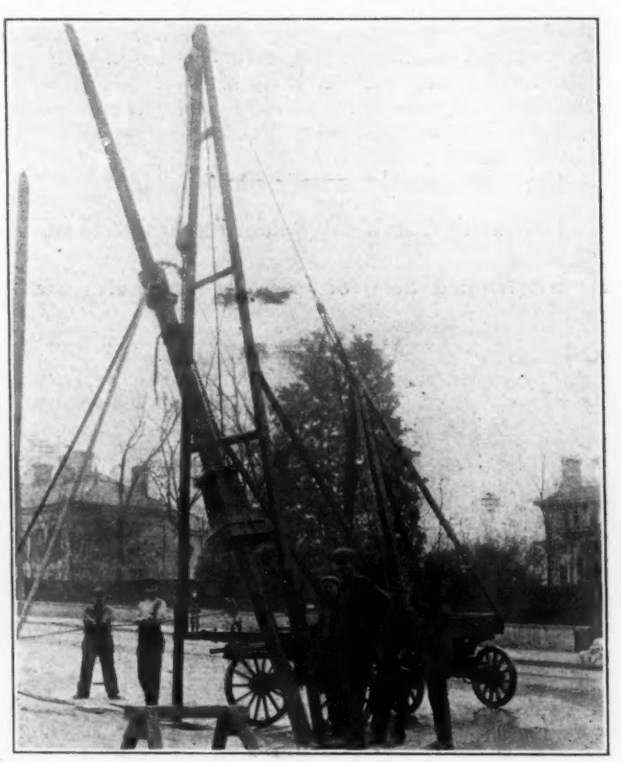
FIG. 3—SUBSTITUTE FOR PULL BOX

support. By the use of this device scrap pieces of conduit may be worked up and used as sleeves which are in reality pull boxes for either horizontal or vertical conduit runs.

These appliances are being manufactured by the Norris Electric Specialty Company and sold by Mr. Colman J. Mullin, 38 Park Row, New York City.

Portable Derrick for Erecting Heavy Poles

A steel-frame pole erector so designed that it may be taken apart for convenience in shipping and which may also be assembled on a 12-ft. wagon bed in less than four hours by a single man has been put on the market by W. N. Matthews & Brother, St. Louis, Mo. The weight of the derrick complete is said to be less than 700 lb. As will be seen from the illustration, the main A-frame of the derrick rests on the street when the pole is in the process of erection but is lifted clear of the ground when the wagon is being moved. Two sets of block and tackle regulate the height and angle of the A-frame and lift the pole so that it



PORTABLE DERRICK FOR ERECTING HEAVY POLES

may be dropped into the hole without the attendant risks which accompany "piking in" a pole of such great weight. It is said that two linemen and a teamster are able to erect from forty to fifty poles a day with the aid of this device,

provided the poles are not over 50 ft. in length. Longer poles may be handled with the derrick but the time required for erecting is somewhat more.

Electrically Heated Earthenware Teapot

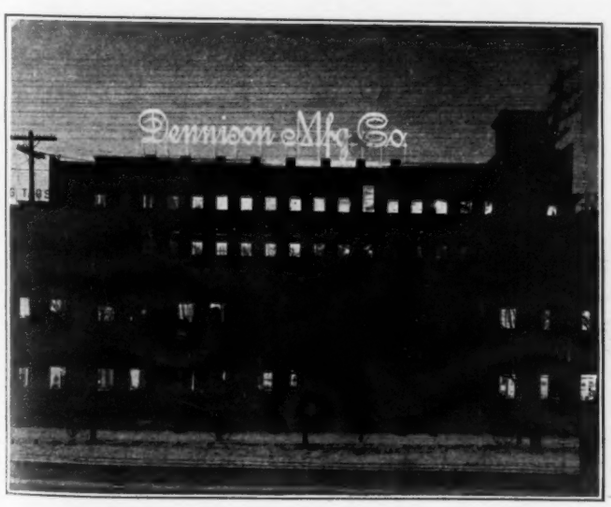
Formerly nearly all lines of electrically heated household devices were finished either in nickel or in copper, but a step in advance has recently been made by the Rochester Stamping Company, which has brought out a line of domestic appliances made in china and earthenware. Both the earthenware teapot and the percolator are being made with the heating unit which was formerly used in the metal products of the same size. The bodies of the devices are said to be made of Guernsey earthenware. To add attractiveness, the bodies are decorated with a design of nickel appliqué over sterling inlay.

For persons desirous of having a percolator of light weight there has been developed an aluminum device equipped with a built-in heating unit. The handle is ebonized with an aluminum tip to prevent burning. The whole device is said to present a very pleasing appearance.

ELECTRICALLY HEATED EARTHEN TEAPOTS AND PERCOLATOR

Sign Illuminated with Reflected Light

An electric sign erected in the town of Framingham, Mass., presents an attractive appearance from the railroad because of its distinctive color, a light emerald green. The reflected light from the hidden lamps gives the sign the appearance of being painted on its background of clouds in phosphorescent paint.



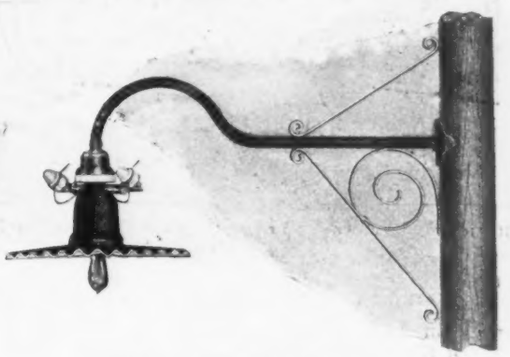
SIGN ILLUMINATED WITH REFLECTED LIGHT

The letters in the sign, which reads "Dennison Mfg. Co.," are made of wood, painted white and mounted on a framework of galvanized-iron pipe. The capital letters are 10 ft. high and the small letters 5 ft. high. The illumination is accomplished by eight Cooper Hewitt automatic lamps, each placed in a galvanized-iron box with glass door. The lamps are equipped with a specially designed reflector which directs the lights so as to cover the entire surface of the letters. The sign is 80 ft. long and the top of the tallest letter is 19 ft. from the roof. The eight lamps furnish a connected load of 1380 watts, or about half the energy, it is estimated, that would be required to illuminate properly a sign of this size with incandescent bulbs.

The lamps for this sign were supplied by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Outdoor Lighting Fixture

The Public Service Company of Northern Illinois has designed a standard type of outdoor tungsten street fixture, which is being made by the Line Material Company, South Milwaukee, Wis. A clover-leaf iron pole plate which is large enough for any pole is provided for securing the fixture. The plate is made of malleable iron and can be shaped to fit small poles. Ornamental steel scrolls above and below the pipe add to the appearance and strength.



OUTDOOR LIGHTING FIXTURE

To one end of the 5-ft. 1-in. pipe goose-neck is attached a non-drop insulator. Between the reflector and insulator there is a malleable-iron spread arm, to which are attached two ordinary wooden pins. Glass insulators can be used upon these pins for supporting the wires to the lamp, insuring good insulation.

Motor-Driven Alternating-Current Fire-Pump Controller

The Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., has recently put on the market a new type of motor-driven alternating-current fire-pump controller. The controller shown in the illustration is intended for use with a 100-hp, 440-volt, three-phase, 60-cycle slip-ring motor. Mounted on the control panel are a voltmeter, an ammeter, a three-pole, rigid-arm, plain-overload circuit-breaker, a three-pole, double-throw knife switch, a pressure governor and a combined manual and automatic fire-pump motor starter. At the back of the panel in a suitable angle-iron frame are mounted the cast-iron resistance grids which are used as the starting resistance in the secondary circuit of the motor. The whole controller is inclosed in a sheet-iron splash-proof case mounted on a pedestal 2 ft. high.

The double-throw knife switch at the base of the panel is used for transferring the motor from one set of service lines to another, as connection to two separate power lines is often provided for reliability. The starter proper consists

of a square shaft above which are mounted the three primary and the six secondary cam-operated switches. There is also an auxiliary cam-operated switch at the extreme right which controls the pilot motor during automatic operation. When operated manually the cam shaft which actuates these switches is revolved by a hand lever shown at the extreme left of the shaft.

STARTING PANEL FOR ALTERNATING-CURRENT FIRE PUMPS

Focusing-Type Flame-Arc Lamp

The focusing-type, long-life flame-arc lamp shown herewith is now being built for operation on either direct-current or alternating-current multiple circuits, multiple series circuits or constant-current series circuits.

The products of combustion of the arc circulate in the inner globe and condensing chamber and are deposited in the latter, keeping the inner globe clear. The condensing chamber is of copper, easily removed and cleaned. The only entrance for water to the condenser is well up under the lamp skirt and is fully protected. A continuous band of copper protects the top of the outer globe. There are no joints exposed to the weather.

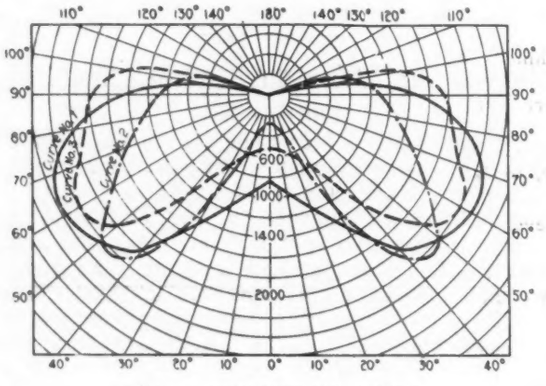


FIG. 1—PHOTOMETRIC CURVES

In the multiple lamps a pair of series solenoids raise the upper carbon through the agency of the clutch acting directly on the carbon. The carbon is raised the entire length of the arc and floated by the solenoids until the lamp feeds, when the lower carbon rises and the arc starts again at the same place.

The feature of the lamp lies in the mechanism of the type built for operation in series on constant-potential, direct-current circuits. These lamps are operated with series solenoids only, avoding the trouble which is occasioned by differential windings in constant-potential series lamps with internal resistance. The solenoids are of a special design which permits of the automatic regulation of the lamps in a series.

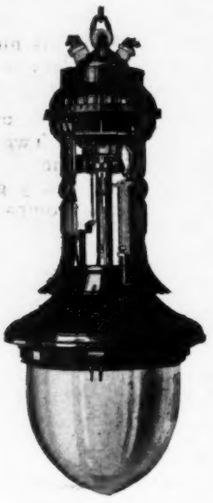


FIG. 2—FOCUSING-TYPE FLAME ARC

The differential principle is used in the constant-current series lamps where the reduction of losses in the mechanism is of prime importance. Separate pairs of series and shunt solenoids operate the clutch through the agency of a walking beam and thus the danger of baked-out shunts is avoided.

OPERATING DATA FROM FLAME-ARC LAMPS

	Multiple Direct-Current Lamp	Multiple Alternating-Current Lamp	Series Alternating-Current Lamp
Terminal volts (average)	110	110	76
Terminal watts (average)	715	507	442
Terminal power-factor (average)	...	62	80
Arc volts	65 to 70	65 to 70	65 to 70
Arc watts (average)	438	422	410
Efficiency	...	83	93
Life per trim	120	120	120
Photometric curve	1	2	3

The data in the accompanying table and the drawings showing the photometric curves for the various lamps give an idea of operating characteristics of the lamps. Curve 1 has been taken from the multiple direct-current lamp operating on a 110-volt circuit and taking a current of 6.5 amp. Curves 2 and 3 were taken from the multiple alternating-current lamp operating on a 110-volt, 60-cycle circuit and taking 7.5 amp and the series alternating-current lamp operating on 60-cycle circuit and taking 7.5 amp at 76 volts.

These lamps are manufactured by the Adams-Bagnall Electric Company, of Cleveland, Ohio.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

New Building of Laclede Gas Light Company.—The Laclede Gas Light Company, which supplies electrical energy for industrial purposes in the central business district of St. Louis, has moved into its fine new eleven-story office building on the corner of Olive and Eleventh Streets. Mr. C. L. Holman is president and general manager.

Flaming-Arc Lamp Business Improving.—The H. M. Hirschberg Company, of 39 East Twentieth Street, New York, reports that its present business in flaming-arc lamps and carbon electrodes is exceptionally good, recent orders being from the Mead Morrison Company, of Boston, and from the Grand Opera House and the Metropolitan Opera House, both of Philadelphia, Pa. H. M. Hirschberg, the president of the company, is planning a trip to Europe during the first week in October, to investigate some improvement work in progress there in connection with both arc lamps and carbons.

Kansas City Firm Pushing Industrial Lighting Business.—The R. W. Hodge Electric Company, of Kansas City, Mo., is just beginning its annual industrial lighting campaign. This is the third year that it has made a special campaign on industrial fixtures, consisting of white-enameled steel shades, principally, made up into several different designs for factory and warehouse lighting. Last year a persistent effort for this kind of fixture business resulted in many more orders than it had anticipated the field would produce. The company is now extending its campaign to a number of adjacent cities in Missouri and Kansas.

Hartford Company Working Overtime.—The Arrow Electric Company, of Hartford, Conn., is employing at the present time the largest force of men ever used in its shops, and overtime work is being done in several departments. In regard to this unprecedented activity, the following statement was given out by E. R. Greer, vice-president of the company: "Our present business is only normal, but when fall comes and the days become shorter we expect that there will be an increased demand for our electrical products. That is the reason for our overtime work and our maximum force of employees. We expect a fine fall business."

Coal Company Orders Electric Mine Locomotives.—The Delaware, Lackawanna & Western Coal Company has just ordered from the Jeffrey Manufacturing Company twenty 7-ton electric locomotives, each equipped with two 40-hp ball-bearing motors of the Jeffrey type, and three 15-ton locomotives, each of which carries three 110-hp motors of the same design. All of these tractors have armor-plate side frames. The order is said to be one of the largest single purchases of this class of equipment ever made in the East, and the larger size locomotives are said to be the first of their kind to be used in the anthracite-coal district.

Industrial Applications of Electrical Machinery.—The industrial applications of electricity are growing more numerous every day, and a report on recent orders for generating control and drive equipment, just received from the General Electric Company, illustrates the diversity of business enterprises in which electricity helps do the work. To mention a few of the different applications of the above nature, the following concerns which have been recent purchasers of General Electric products may be cited: New Castle (Pa.) Portland Cement Company; Delaware, Lackawanna & Western Railroad Company; United States Aluminum Company, New Kensington, Pa.; H. U. L. Chase Bag Company, St. Louis, Mo.; Standard Oil Company, New York; New Haven (Conn.) Clock Company, and the Snider Manufacturing Company, of Logan, Ohio, furniture manufacturer.

Louisville Exposition a Success.—A "Made-in-Louisville" exposition was held last week at Louisville, Ky., and the Louisville Gas & Electric Company turned over to the exhibitors the Electric Building, which was headquarters for the Kentucky Electric Company before the recent merger. A number of electrical exhibits were housed in this structure, among them an electric-welding outfit shown by the Stratton & Terstegge Company. The James Clark, Jr., Electric Company, manufacturer of electrical apparatus, attracted wide attention with its line of direct-connected, motor-driven machine tools, one of which was displayed in a Fourth Avenue shop window.

New St. Louis Office of the General Electric Company.—The General Electric Company has moved its district offices in St. Louis from the Wainwright Building to the thirteenth floor of the Pierce Building, on Fourth Street, extending from Chestnut to Pine Street. The Pierce Building is across the street from the Planters' Hotel, a location well known to visitors in St. Louis. The new quarters are larger than the old ones and have been made necessary by increasing business. Mr. F. N. Boyer is the district manager in charge of the St. Louis office, which now reports directly to the main office in Schenectady and is no longer a sub-office of the Chicago office.

New Electric Vehicle Marketed.—From C. F. Guyon, of 100 William Street, New York, representing the Champion Electric Vehicle Company, of Owego, N. Y., it is learned that the company is prepared, after a lengthy period of development, to give prompt deliveries on its new line of 750-lb., 1000-lb. and 2000-lb. delivery wagons. These cars have a maximum speed of 12 to 14 miles per hour and are good for 60 miles on one charge of the battery. They will be on exhibition at the electric-vehicle show in the Grand Central Palace, New York, next month. The Eastern sales agent for these new cars is the Henry Tobin Company, Inc., of 150 West Fifty-fifth Street, New York.

Central Stations Buy York Refrigerating Machines.—Among the recent purchasers of refrigerating apparatus from the York Manufacturing Company, of York, Pa., are the United Electric Light & Power Company, of New York, which took an 8-ton machine, and the Fayette Light, Ice & Coal Company, of Fayette, Mo., to which a 30-ton machine was sold. The aggregate capacity of the refrigerating machines sold by the York company since its last report is 1422 tons, mostly in small units, although there are included in that total two machines of 175 tons capacity each, one of which was sold to the Long Island Ice Company, of Brooklyn, N. Y., and the other to the Duquoin (Ill.) Utility Company.

Cleveland Electrical Companies Merged.—Three large electrical companies in Cleveland, Ohio, have been merged to create the Elliott Electric Company, which will have its office at 322 Champlain Avenue, N. W. The new concern has taken over the business of the S. K. Elliott Electric Company, retaining for the present the old company's headquarters and equipment. S. K. Elliott will now be associated wth the new corporation. In addition to taking over the S. K. Elliott Electric Company the new concern acquires the Motor Rental & Sales Company and the Ripple Engineering Company. With the new organization will be associated the Miller-Seldon Electrical Company, Detroit, Mich. The company will sell, rent and exchange electrical machinery for engineering and construction work and will also act as selling agent for the Sterling Electric Lamp Company. A specialty will be made of renting motors and

power machinery. W. H. Seldon, Jr., of Detroit, is president of the new company; M. C. Ripple is treasurer and general manager, and L. B. Holt is secretary.

Rubber Company Installing Electric Drive.—The Pennsylvania Rubber Company, of Jeannette, Pa., will equip its plant with new apparatus for electrical drive, consisting of a 500-kw Curtis turbo-generator, one 300-hp motor, four motors of 40 hp and 75 hp, control panels, switchboard and accessories. All of this apparatus has been ordered from the General Electric Company.

Detroit Electrics to Be Sold at Reduced Prices.—A. Weatherby, Boston manager of the Anderson Electric Car Company, of Detroit, Mich., stated in a recent interview that prices on the 1914 models will be materially reduced from those prevailing this year. Next year's cars will contain many improvements including larger battery capacity, larger tires, electric brakes, longer wheelbase, roomier bodies and longer and wider seats. Purchasers will be allowed the choice of worm or bevel-gear drive and rear seat or duplex steering control.

Dayton Company Replaces Old Power-Plant Apparatus.—At the plant of the National Cash Register Company, Dayton, Ohio, extensive changes in power equipment are in progress. Two new Stirling boilers of 610-hp rating are being put in to replace four old boilers. Steam will be generated at 175 lb. pressure and carried through a Foster superheater, where it will be raised to 75 deg. superheat. The boiler auxiliaries will include Murphy stokers, two to each boiler, Simplex blow-off valves and a Williams combination feed regulator and water column. An Allis-Chalmers turbo-generator set of 2000-kw normal capacity is also being installed. This will operate at 3600 r.p.m. on 155 lb. of steam at 75 deg. superheat. The generator will deliver three-phase, 60-cycle current at 440 volts. A Westinghouse-La Blanc condenser will supply the vacuum in the turbine, and a reducing valve will also be installed to assist one of the present reciprocating units in maintaining a constant pressure of 1¾ lb. on the exhaust-heating system.

Optimistic View of the Lamp Situation.—Supplementing the note contained in the issue of Aug. 26, one received from J. W. Morrell, president of the Eastern Electric Lamp Company Division of the Franklin Electric Manufacturing Company, reflects a spirit of optimism which seems to prevail generally among the members of the electric-lamp fraternity. Mr. Morrell says, in part: "The Eastern Electric Lamp Company anticipates no changes in management or sales methods, having obtained satisfactory results with the personnel and sales system at present employed. The growth of the business has, however, justified the acquisition of additional large manufacturing plants located at Middletown, Conn., which this concern, in conjunction with its associated companies, expects to equip, as rapidly as possible, to handle the growing demand for its goods. In addition to two large plants already in full operation, the factory property referred to above will probably be partly equipped and running by Oct. 1, on which date the company expects to be producing 3000 finished lamps per day, a production which will be steadily augmented during the late fall and winter as additional equipment is installed." This statement corrects the statement previously made in these columns to the effect that the Middletown plant would start operations on or about Jan. 1, 1914.

General Electric Equipment Sold to Steel Mills.—In addition to the large motor order from the Bethlehem Steel Company noted elsewhere, the General Electric Company, of Schenectady, N. Y., has recently received orders for various kinds of electrical equipment from a number of other companies in the same field. The American Sheet & Tin Plate Company, of Pittsburgh, Pa., will add to its electrical equipment at Gary, Ind., two 1600-hp General Electric mill-type motors with sectional control equipments and panels. From the Otis Steel Company, Cleveland, Ohio, has been received an extensive order for electric drive equipment, including two 4500-kw Curtis turbo-generator units with a 100-kw turbo-exciter and a 50-kw motor-generator exciter set; two 1000-kw two-unit two-bearing motor-generator sets; three 400-kva transformers; one 1500-hp, two 1200-hp and one 200-hp motor; switchboard panels and accessories. An installation of one 875-hp and four 75-hp mill-type motors is to be made at the plant of the Brier Hill Steel Company, Youngstown, Ohio, and the National Tube Company will add to the electrical equipment of its Pennsylvania works two 150-hp induction motors. The Illinois Iron & Bolt Company, of Carpentersville, Ill., will equip for electric drive and install fifteen motors ranging from 3 hp to 40 hp, with oil switches and accessories, all of which will be furnished by the General Electric Company.

Central Stations Use New Flexible Coupling.—Among the leading central stations in which the Francke flexible coupling is being used are those of the Public Service Railway Company of New Jersey, the New York Edison Company and the Interborough Rapid Transit Company of New York. The Rochester (N. Y.) Railway & Light Company is one of the most recent purchasers. This all-metal coupling, sold by the Smith-Serrell Company, New York, is adaptable to a wide range of service. With the growing popularity of the direct-connected turbo-generator set has come an increasing demand for the coupling from the leading manufacturers of such units, and the General Electric Company is furnishing it with the new 1000-kw set recently placed on the market and operating at 3600 r.p.m. Other places where the device has been installed with entire satisfaction are on gas-engine generator sets, on motor-driven fan equipment and on regular line-shaft connections. The couplings are made for all shaft sizes from ¾ in. up to 20 in.

Electrification of Bethlehem Steel Plant Extension.—The Bethlehem Steel Company is at present equipping the bar-mill extension at its Lehigh plant, South Bethlehem, Pa. Electric drive is to be used throughout. Three General Electric three-phase alternators of 2500-kw rating will be installed, directly connected to Bethlehem Steel gas engines, and will supply energy at 80 per cent power-factor, 25 cycles and 6600 volts, for the power demands of the mill. Excitation will be furnished from a motor-generator set at 240 volts, and arrangements are to be made so that the present direct-current system will serve as an emergency source. The switchboard gallery will contain control panels for the alternators and feeder circuits and the motor-operated oil switches will be located beneath it. Duplicate full-capacity buses will be used with an auxiliary bus carrying a spare switch for the alternators and the same arrangements for the feeders. A 1500-kw reversible motor-generator set will tie the two systems together. The energy-consuming apparatus to be installed in the mill is varied. A 10-ton Girod electric furnace will be put in and fed through furnace transformers of the Pittsburgh Transformer Company. The General Electric Company will supply for drive purposes fourteen induction motors (seven of them two-speed motors), ranging from 350 hp up to 4500 hp, for direct connection to the rolling mills. The Westinghouse Electric & Manufacturing Company is furnishing a 35-in. reversing blooming-mill equipment, consisting of a flywheel motor-generator set, made up of a slip-ring induction motor and two 600-volt direct-current generators connected in series, together with complete switchboard and exciter apparatus. The motors on the blooming mill will be similar to the above generators, being 600 volts each and connected in series. The Crocker-Wheeler Company will supply for this installation three 500-kw motor-generator sets which will furnish direct current at 240 volts for operating mill tables, cranes and small motors. The mill tables will be driven by Westinghouse motors, operated by the Electric Controller & Manufacturing Company's magnetic controllers. The crane equipment is being built by the Morgan Engineering Company and the Alliance Machine Company and includes about twenty cranes, all designed after modern steel-mill specifications and equipped with the latest safety devices. The cranes will be driven and operated in the same way as the mill tables. This equipment work is going on under the direction of W. F. Roberts, general superintendent of the Lehigh plant, and it is interesting to note that, while all the small motors are to be operated on 240 volts, alternating or direct current according to the character of the service they give, all alternating-current motors above 350-hp capacity are to be operated directly at 6600 volts.

Corporate and Financial

Plant at Sault Ste. Marie Sold to Bondholders.—The plant of the Michigan & Lake Superior Power Company at Sault Ste. Marie, Mich., was sold on Aug. 26 to a representative of the first-mortgage bondholders for $3,500,000. The property will be transferred to the Michigan Northern Power Company, a new corporation, which will make improvements in order that all the water available may be utilized, which would give 35,000 hp for industry purposes.

Earnings of the Southern California Edison Company.—In connection with an offering of bonds of the Southern California Edison Company by N. W. Harris & Company, of Boston, a statement of earnings has been issued for the year ended June 30, 1913. It shows total operating revenue, including other income, of $4,538,893, operating expenses of $2,383,479 and net income of $2,155,414. Interest charges were $773,200 and deduction of $650,000 was made for depreciation, leaving a surplus of $732,214.

Purchase of Control of the American Cities Company.—The United Gas & Electric Corporation plans to purchase the majority of the common stock of the American Cities Company. For each $100 share of common stock of the American Cities Company it will pay $75 of a new issue of graduated second preferred stock and $25 of common stock. The additional class of stock which it is proposed to create, graduated second preferred, will bear cumulative dividends at the rate of 2 per cent per annum for the year 1914, 3 per cent for 1915, 4 per cent for 1916, 5 per cent for 1917 and 6 per cent for all succeeding years. The American Cities Company controls the New Orleans Railway & Light Company, the Birmingham Railway, Light & Power Company, the Little Rock Railway & Electric Company, the Memphis Street Railway Company, the Knoxville Railway & Light Company, and the Houston Lighting & Power Company.

Washington Water Power Company Notes.—An issue of about $500,000 of 7 per cent notes of the Washington Water Power Company, offered to shareholders, has been fully subscribed. Another issue of notes, extending for six weeks, will probably be made in December. The total amount of notes outstanding on Feb. 1, 1914, will be about $2,000,000. To provide for the notes maturing on that date the company will probably issue 10 per cent of new stock. It is proposed to issue this stock on April 1, 1914, but to offer it to shareholders with the right of prepayment on Feb. 2, 1914. The amount of capital stock outstanding now is $14,081,900. There has been expended on the hydro-electric development at Long Lake $3,427,215 of the estimated total cost of $5,000,000. The company also has acquired for $450,000 the distributing system of the Idaho-Washington Light & Power Company, and it has made other capital expenditures.

Certificates in Small Denominations Issued by Middle West Utilities Company.—The last $1,500,000 of an authorized issue of $3,500,000 of three-year 6 per cent collateral gold notes of the Middle West Utilities Company are offered for sale at 97½ and interest. At this price they yield the investor 7 per cent. The notes are secured by the deposit with a trustee of $4,667,000 par value of mortgage bonds of subsidiary companies. In his letter describing the issue Samuel Insull, the president, calls attention to the arrangement whereby certificates in denominations of $100 and $500 are available. These are secured by the deposit with the trustee of an equal amount of the collateral notes, and they offer the small investor, therefore, substantially the same opportunity of investment as the buyer of the notes, which are issued only in denominations of $1,000. The certificates are convertible directly into the notes if presented for this purpose in amounts of $1,000 or multiples thereof. The indenture securing the issued notes provides that the issue may be redeemed in whole or in part at par and interest on any interest date upon sixty days' notice. If any of the notes pledged as security for certificates of the smaller denominations should be called, at least an equivalent amount of the certificates issued against the notes will be redeemed at the same time. The letter of Mr. Insull shows that the number of communities served by the subsidiary operating companies is 274, with an estimated population of 829,600. The communities and estimated population of the properties located in the various states are as follows: In Illinois, 195 communities, 433,400 population; in Indiana, 29 communities, 151,000 population; in Kentucky, 13 communities, 53,500 population; in Missouri, 2 communities, 15,000 population; in Michigan, 6 communities, 36,000 population; in Oklahoma, 6 communities, 61,700 population; in New England, 23 communities, 79,000 population. Except in Michigan, separate operating subsidiary companies have been formed in all the states.

Standard Gas & Electric Company Preferred Dividend Paid in Scrip.—The quarterly dividend of 2 per cent due on Sept. 15 on the preferred stock of the Standard Gas & Electric Company will be paid in scrip instead of in cash. The scrip will bear 6 per cent interest and will be due on Sept. 1, 1923, although the company reserves the right of payment before that date. H. M. Byllesby, president of the company, issued a statement on Aug. 28 explaining the reasons for this action. He says in part: "With what is deemed to be at present a proper maintenance and depreciation charge taken from the net earnings of the subsidiary companies and dealing with the results of the elapsed net earnings of these companies for the twelve months ended July 31, 1913, Standard will receive from its holdings in the subsidiary companies in the ensuing twelve months, without cramping or straining these subsidiary companies, an income which, after providing for its operating expenses and bond and coupon note interest, will be equivalent to more than 6 per cent upon Standard's preferred capital stock. With the cessation of a cash distribution on its preferred stock Standard will be able to retire from its income, after paying its operating expenses and interest on its bonds and coupon notes, the $500,000 par value of its coupon notes maturing June 1, 1914, and the balance of its surplus income, together with the proceeds of the reserved $350,000 par value of coupon notes, will, it is believed, enable Standard to supply that part of the construction requirements of its controlled companies which cannot be economically provided from the sale of the treasury securities of those companies. Judged by all previous experience and by a close study of the individual conditions surrounding the subsidiary companies, it appears fair to believe that they have successfully passed through their trying experiences; that the protection against reckless competition which is being afforded by the various commissions and regulatory bodies in consideration of the rights of these bodies to regulate the charges of the utility companies in their jurisdiction, within reasonable limits, is resulting in a more satisfactory condition of operations than has heretofore existed and leading to the belief that the income of Standard from its holdings in its subsidiary companies will increase, and that in the interest of all of its stockholders the suspension for a time of the payment of cash dividends is in the direction of building up the intrinsic value of all of its holdings, which, it is believed, will show, within a reasonable time, satisfactory results."

NEW YORK METAL MARKET PRICES

	Aug. 25		Sept. 2	
Copper:	Bid.	Asked.	Bid.	Asked.
Standard, spot*	....	16.00	....	....
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	69 10 0		71 12 6	
Prime Lake	15.85	to 15.95	.....	16.25
Electrolytic	15.70	to 15.80	16.12½	to 16.25
Casting	15.60	to 15.70	15.87½	to 16.00
Copper wire base	16.75	to 17.00	17.00	to 17.25
Lead	4.75		4.75	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f. o. b. smelter	7.75		8.00	
Spelter, spot	....	5.87½	.....	5.90
Tin, spot*	41.15	to 41.50	42.90	to 43.25
Aluminum:				
Prompt delivery	22.25	to 22.75	21.50	to 22.50
Future	20.00	to 21.00	20.00	to 21.00

*OLD METALS

Heavy copper and wire	14.50	14.50
Brass, heavy	9.25	9.25
Brass, light	8.25	8.25
Lead, heavy	4.65	4.65
Zinc, scrap	4.62½	4.62½

*COPPER EXPORTS

Total tons to Sept 2 1790

*From daily transactions on the New York Metal Exchange.

Business Notes

The Straight Filament Lamp Company, formerly of 125 West Forty-second Street, New York, has moved its sales office to 42 East Twenty-third Street in the same city.

The General Insulate Company, of Brooklyn, N. Y., manufacturer of hard-rubber specialties, has appointed the William J. McKenna Company, 9 South Clinton Street, as its agent in the Chicago territory in place of A. J. Cox & Company, former representatives.

The Bittman Electric Company, of Chicago, Ill., opened an Eastern office at 71-73 Murray Street, New York, on Sept. 2. This office is in charge of A. J. Saunders, who has had a wide experience in handling this company's line of suction clearners, massage vibrators and electric hair driers. The company intends to carry at this office a complete stock of all its goods and to be prepared to compete in every way with Eastern manufacturers.

New Industrial Companies

The Pennsylvania Telectrophone Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,500,000. The incorporators are W. G. Taylor, C. B. Bishop and H. W. Davis, of Wilmington, Del.

The Illumination Development Company, of New York, N. Y., has been incorporated by Clinton D. Tabor, John F. Harrington and Harry M. Kimball, 312 West Twenty-second Street, New York. The company is capitalized at $50,000 and proposes to do a general contracting and electrical engineering business.

The Golson Electric Company, of Selma, Ala., has been chartered with a capital stock of $2,000 for the purpose of doing a general electric and wiring business. The officers are: B. J. Schuster, president; Rudolph Richards, vice-president; Albert Thalheimer, treasurer, and D. H. Golson, secretary and general manager.

The Spanish-American Engineering Company, of New York, N. Y., has been granted a charter with a capital stock of $25,000 for the purpose of manufacturing and dealing in machinery and engineering appliances. The incorporators are Edward R. Aparicio, Manuel S. Ayau and Eduardo A. Brun, 15 William Street, New York, N. Y.

Trade Publications

Pole-Line Anchors.—A six-page booklet has been issued by the Oshkosh Manufacturing Company, Oshkosh, Wis., which describes in detail the new Oshkosh patent anchor.

Portable Electric Hoists.—A folder has been issued by the Northern Engineering Works, Detroit, Mich., which refers briefly to its various types of portable electric hoists for either direct-current or alternating-current circuits. Seven illustrations are given.

Cable Supports and Sleeves.—A catalog and price list of the Hercules and Ajax vertical feeder or cable supports and sleeves has been issued by the Norris Electric Specialties Company, Chicago. Brief descriptive matter and a number of illustrations are given.

Generator Sets.—Brief references to its electric-light, gas-engine-driven plants for moving-picture work, motor-generator sets, switchboards and instruments are made in a leaflet, 6 in. by 9 in., recently issued by the Barber-Dwinnell Company, 600 East Fifteenth Street, Kansas City, Mo.

Battery-Charging Rheostats.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has just printed a new edition of Bulletin 8540. It contains prices and data on the various types of battery-charging rheostats for both lead and nickel-iron batteries, including wall, floor and switchboard types, and also two styles of automatic rheostats.

Farm-Lighting Outfits.—In a booklet of eighteen pages being sent out by the Commercial Electrical Supply Company, Fifteenth and Pine Streets, St. Louis, Mo., entitled "Electric Light for the Farmer," the "Commercial" lighting outfits for farms are discussed. The company installs plants of from ten lamps to 1500 lamps. A photograph of a fifteen-lamp plant is shown.

Electric Welding.—In a booklet issued by the Electric Welding Company, 220 West Forty-second Street, New York, is given a historical account of electric-arc welding and considerable general information on the subject. In the foreword the company sets forth its facilities for scientific welding, as it maintains a staff of specialists to solve welding problems and a corps of skilled welders to undertake work at short notice.

Lead-Lined Iron Pipe.—The Lead-Lined Iron Pipe Company, Wakefield, Mass., is sending out large post cards on which is given a table of comparison of net prices of brass pipe and lead-lined iron pipe in sizes that are available. Lead-lined iron pipe is used for conveying acid, hot or cold water, boiler-feed and corrosive liquids. The company also manufactures tin-lined iron stopcocks and valves and lead-lined iron stopcocks and valves.

Water Softeners.—Mr. Elbert Hubbard is the author of a "little journey" to the plant of the Kennicott Company, Chicago Heights, Ill. In this booklet is told the story of the Kennicott water-softening process and of other manufactures of the Kennicott Company. Some interesting information on the general subject of water is also given, as well as a brief history of the personnel of the company, written in Fra Elbertus' inimitable style.

Electric Washers.—Automatic electric and power washers are the subject of a recent catalog issued by the Automatic Electric Washer Company, Newton, Ia. The power washer is equipped with a pulley for engine drive, and the electric washer is equipped with a motor. Illustrations are given of both types, as well as of an automatic wringer and of an ironer—a complete home laundry equipment of interest to all householders, and to central stations as a means of increase in the day load.

Asbestosteel.—Bulletin 53, just issued by the Asbestos Protected Metals Company, of Beaver Falls, Pa., describes the use of its product in the fabrication of modern walls and roofs, the principal application being in factory, mill and electrical station construction and in railroad buildings. Physically the booklet presents a finished appearance that invites attention, and the text contains matter of vital interest to all concerns who have structures of the above description to build or repair.

Instruments.—The Esterline Company, Indianapolis, Ind., has recently distributed a number of sheets for insertion in a binder furnished for the purpose. These sheets are issued periodically and are arranged in the loose-leaf form. They contain brief references to the various instruments manufactured by the company, tabulated in a form convenient for the prospective purchaser. In addition, a number of sheets are included giving instructions for operating graphic meters. The binder is provided with space for additional sheets as issued.

Electric Hoists.—Electric hoists are the subject of Bulletin No. 12 of the Lidgerwood Manufacturing Company, 96 Liberty Street, New York. The facility with which electricity can now be obtained and the convenience and economy of its distribution have created a large demand for this class of apparatus. In this bulletin are given data and illustrations of the single-friction drum electric hoist with brake, the double-friction drum, electric hoists with drums revolving in opposite directions, jaw-clutch reversible electric mining hoists, and a number of other types.

Pumps.—The wide interest in the subject of irrigation makes timely the recent publication of Henry R. Worthington, 115 Broadway, New York City, which has for its subject "The Conservation and Distribution of Water for Irrigation." Many of the data contained therein and also the methods described are based on results from government and commercial work, both experimental and by actual practice in the field. The text is full of interest and the illustrations are attracive. The publication contains descriptions of various types of Worthington pumping apparatus for irrigation purposes and also some useful data and tables.

Personal Mention

Mr. T. V. Smith has resigned as engineer of the Laramie (Wyo.) Electric Company.

Mr. E. N. Cunningham has assumed the management of the Mount Pleasant (Tenn.) Electric Company, which he recently purchased.

Mr. C. A. Semrad has been appointed manager of the Cheyenne (Wyo.) Light, Fuel & Power Company as successor to Mr. W. L. Kemper.

Mr. H. M. Harris has been elected superintendent of the Jackson (Tenn.) Municipal Electric Light and Water Works as successor to Mr. T. H. Hartmus.

Mr. Edward J. McGuire, of Buffalo, has been appointed engineer in the division of light, heat and power of the Public Service Commission, Second District, New York.

Mr. J. E. Weiss, superintendent of electrical distribution of the Racine division of the Milwaukee Electric Railway & Light Company, has tendered his resignation, effective Sept. 15.

Mr. L. L. Stone, Pikeville, Ky., is general manager of the Sandy Valley Light & Power Company, Inc., which recently took over the Pike Light & Power Company, of Pikeville.

Mr. F. C. Maurer, formerly connected with the Lake Superior Paper Company at Sault Ste. Marie, Mich., has been appointed operating engineer of the Des Moines (Ia.) Electric Company.

Mr. D. W. Smith, formerly with the Westinghouse Electric & Manufacturing Company, has been appointed manager of motor sales of the Robbins & Myers Company, Springfield, Ohio.

Mr. W. T. Pratt, formerly superintendent of the United Electric Light & Water Company of Waterbury, Conn., has been made superintendent of the company's system at Naugatuck, Conn.

Mr. J. R. Paschall, of Richmond, Va., a director of the Piedmont Railway & Electric Company, of Burlington, N. C., returned Aug. 27 on the *Imperator* from a trip of two months abroad.

Mr. J. S. Viehe has resigned from the engineering department of the Electric Bond & Share Company and is now connected with Westinghouse, Church, Kerr & Company, New York City.

Mr. B. D. Christian, who was formerly with the new-business department of the Merchants' Heat & Light Company, Indianapolis, Ind., has recently been made chief electrician of that company.

Mr. Guy E. Fairly has resigned as superintendent of the Corona (Cal.) Gas & Electric Company, which is controlled by the Southern Sierras Power Company, and has been succeeded by Mr. C. C. Bartlett.

Mr. Lawrence Whittredge Cady, formerly consulting engineer for the Browning Engineering Company and its allied companies, has opened an office at Lakewood, Ohio, for general consulting engineering work.

Mr. F. H. Hill, operating engineer for the United Gas & Electric Corporation, of 40 Wall Street, New York, has been made acting general manager of the Elmira (N. Y.) Water, Light & Railroad Company.

Mr. J. F. L. Clack has resigned his position as manager of the municipal lighting and water plant at Portales, N. M., and has become associated with the Mountain State Telegraph & Telephone Company, Phoenix, Ariz.

Mr. P. A. Rogers, commercial agent of the Dallas (Tex.) Electric Light & Power Company, has been appointed local manager of the Texas Power & Light Company at Denison, Tex., in place of Mr. W. A. Everett, resigned.

Mr. P. L. Nourse, superintendent of distribution for the Rome (N. Y.) Gas, Electric Light & Power Company, for seven years, has been appointed division superintendent at Elsinore (Cal.) for the Southern Sierras Power Company.

Mr. J. C. Kennedy, chief engineer of the Brenham (Tex.) Compress Oil & Manufacturing Company, which does the electric-lighting business in that town, has been elected secretary of the company vice Mr. W. R. Jahnke, resigned.

Mr. F. J. Lyon, superintendent of the Naugatuck branch of the United Electric Light & Water Company and also of the Seymour (Conn.) Electric Light Company, has been appointed assistant superintendent of the Waterbury division.

Mr. Arthur B. Carpenter, Southern representative of the Rumsey Electric Company, of Philadelphia, Pa., has resigned and removed to Valdosta, Ga., to take charge of the branch office of the Electric Supply & Engineering Corporation.

Mr. William Laidlaw, formerly owner of the Ohio (Ill.) Electric Company, has purchased the stock of the Meeker (Col.) Electric Light, Heat & Power Company and removed from Ohio to Meeker on Sept. 1 to take up the management of the property.

Mr. W. A. Cullinane has been appointed manager of the Pryor (Okla.) Ice & Light Company. Mr. Cullinane is a son of Mr. John R. Cullinane, of St. Louis, for a number of years prominent in the management of utilities in Texas and other Southwestern States.

Mr. E. R. Chisholm has been appointed superintendent of the Tupelo (Miss.) Municipal Electric Light, Water & Sewerage Company, and the former incumbent, Mr. W. H. St. John, has been made assistant superintendent. The manager of the company is Mr. C. E. Goodlett.

Mr. F. H. Miller, local manager for the Interstate Public Service Company at Lebanon, Ind., has been transferred to the central Indiana district, with headquarters at Columbus, Ind. Mr. Miller will have charge of the system in Seymour, Columbus, Franklin and Greenwood.

Mr. C. A. Orr has been appointed superintendent of the plant and shops of the Arkansas Valley Railway Light & Power Company of Pueblo, Col., vice Mr. C. M. Caster, resigned. Mr. Orr was formerly engaged in similar work at Peoria, Ill., Sioux Falls, S. D., Ottumwa, Ia., and other points.

Mr. E. B. Nance has been appointed chief accountant of the Idaho Railway, Light & Power Company, of Boise, Idaho. The Idaho company has five power plants and more than 100 miles of interurban lines and supplies numerous towns with electrical energy from its high-tension system.

Mr. H. V. Slusor, formerly superintendent and chief engineer of the County Electric Company, of New Philadelphia, Ohio, has severed his connection with the company to engage in the electric contracting and supply business in New Philadelphia under the name of the Advance Electric Company.

Mr. Harold Almert, chief of the department of examinations and reports of H. M. Byllesby & Company, has been appointed appraiser for the Chicago Reducton Company, to be one of three to fix the valuation of the p of the company, which the city of Chicago is under contract to purchase.

Mr. A. H. Kimball, general manager of the Fall River (Mass.) Electric Light Company, was presented with a pin by the employees of the company as a memento of the opening of Fall River's "great white way." The pin is a model "white-way" pole with a diamond center and rim penetrating a gold circle.

Mr. Norman McD. Crawford, who recently resigned as president of the Mahoning & Shenango Railway & Light Company, of Youngstown, Ohio, the principal subsidiary of the Republic Railway & Light Company, has removed to New York City, where he will be connected with electric railway and lighting interests.

Mr. Thomas A. Edison, who is at present on an automobile trip through New England, was reported ill at Portland, Me., on Sept. 1. The report, however, was unfounded. Mr. Edison had motored 500 miles on the two previous days and felt somewhat fatigued. He continued his trip the next morning with his family.

Mr. Edson O. Sessions has opened an office in the Marquette Building, Chicago, for consulting and expert engineering work. Mr. Sessions, who is a fellow of the A. I. E. E., a member of the A. S. M. E., an associate of A. S. C. E. and a member of the I. E. S., has been engaged in construction and engineering work for over twenty years.

Mr. C. G. M. Thomas, vice-president and general manager of the New York & Queens Electric Light & Power Company, Long Island City, N. Y., was elected president of the company at a recent meeting of the board of directors. This is a fitting testimonial of appreciation of Mr. Thomas's efficient services to the lighting industry in New York City during the past twenty-five years.

Mr. Claude Curtis, of Boston, Mass., has been appointed superintendent of the Houghton County Electric Light Company, of Houghton, Mich., owned by the Stone & Webster Company, of Boston. Mr. Curtis recently returned from a three months' trip to Cuba in the interests of his firm. For four years he was manager of the company's plant in Porto Rico. Mr. Curtis was graduated from the University of Michigan in 1907.

Mr. Elmer A. Holbrook, professor of mining engineering in the Nova Scotia Technical College, has been appointed assistant professor of mining engineering at the University of Illinois, where he will have charge of the recently equipped coal-washing and ore-dressing laboratory and a course in mine design. Professor Holbrook graduated from the Massachusetts Institute of Technology in 1904 and spent five years in active mine and mill management work in the United States, Canada and Mexico. He has been connected with the Nova Scotia Technical College for the past three years.

Mr. James D. Robertson, formerly sales manager for the Pittsburgh (Pa.) Valve, Foundry & Construction Company, has again assumed charge of the sales of that company, returning as second vice-president after two years' absence. Mr. Robertson in the meantime completed the organization, plant, etc., of the Warren (Ohio) Tool & Forge Company. He began his business career with Atwood & McCaffrey, and when that concern was absorbed by the Pittsburgh Valve, Foundry & Construction Company he continued his services and at the time of his withdrawal had completed his twenty-first year with the company.

Prof. Lewis E. Young, who for the past six years has been director of the Missouri School of Mines, will take up graduate work in the department of economics at the University of Illinois in September and will also give part of his time to teaching in the department of mining engineering. Professor Young was graduated from the Pennsylvania State College in 1900, since which time he has studied at the Michigan College of Mines and at the University of Chicago. He has taught at the Iowa State College and has been professor of mining at the Colorado School of Mines and director of the Missouri School of Mines. For some years Professor Young has made a special study of the economics of mining, taxation and political economy.

Mr. John Hunter, chief engineer of the Union Electric Light & Power Company of St. Louis, is the subject of an interesting sketch, with portrait, printed in the *Union Electric Bulletin* for August. Mr. Hunter, who was for a number of years an engineer in the marine service, left the sea in 1905 with the rank of chief engineer United States Navy. Captain (afterward Admiral) Sigsbee, in an official report made in 1896, said of Lieutenant Hunter: "On one occasion, when there were two fires in a coal bunker, he worked without food, and nearly to physical collapse, for a whole day and succeeded in putting out the fires—one of the finest achievements that I have ever known on shipboard." Mr. Hunter became connected with the St. Louis company in the year first mentioned. At the present time he is also the president of the Engineers' Club of St. Louis.

Mr. J. R. McKee, a vice-president of the General Electric Company and one of the pioneers in the electrical industry, has tendered his resignation and will retire from the company. This announcement confirms the rumor which has been current for several months that Mr. Kee desired to devote all of his time to personal affairs and would therefore sever his long-standing connection with the General Electric Company. Mr. McKee joined the Thomson-Van Der Poel Electric Mining Company as president at the time of its organization. He was also manager of the Thomson-Houston Motor Company. These activities in 1890 and 1891 resulted in his being made manager of the power and mining department of the General Electric Company when it was organized in 1893. The tremendous growth of this branch of the business is perhaps the best evidence of the success which has crowned Mr. McKee's untiring efforts. His field of endeavor was greatly broadened when in 1908 he was appointed chairman of the sales committee. In 1912 Mr. McKee was elected a vice-president of the company. Mr. McKee's resignation after twenty-three years of active service with the General Electric Company has been reluctantly accepted. As a pioneer in the effort to apply electricity to industrial purposes, Mr. McKee's activities have extended into all parts of the country and through various industries. His circle of friends and acquaintances is unusually large.

Obituary

George H. Collins, an electrical engineer of Brooklyn, N. Y., died at his home, 1258 New York Avenue, that city, Aug. 30, at the age of forty-six.

Joseph C. Eichmeyer, an inventor and designer of fire-alarm and police-telegraph signal systems, died at Utica, N. Y., Aug. 31, aged fifty-four years. Mr. Eichmeyer invented and installed in Schenectady the first police flash system of the selective type, this being used to summon policemen whenever the central office desired to get in touch with them.

F. V. T. Lee, who was one of the best known electrical engineers on the Pacific Coast and associated with Messrs. J. Martin, E. J. De Sabla, Jr., and others prominently identified with hydroelectric developments in California, died at Victoria, B. C., on Aug. 14. Mr. Lee was a native of England and came to America at the age of seventeen, entering the employ of the Manhattan Electrical Supply Company in New York City. While there he attracted the attention of the late Dr. F. A. C. Perrine, at that time professor of electrical engineering at the Leland Stanford, Jr., University and later chief engineer of the Standard Electric Company of California. Dr. Perrine induced him to come to California and enter the Leland Stanford, Jr., University, where he worked his way through. Mr. Lee had a hand in the construction of several of the hydroelectric plants which are now the property of the Pacific Gas & Electric Company. In 1906 he left John Martin & Company and entered the service of the Pacific Gas & Electric Company, with which he remained until 1910, being assistant general manager of the company when he resigned and went North. Mr. Lee was a member of the American Institute of Electrical Engineers and several kindred societies.

Fred H. Daniels, chief engineer of the American Steel & Wire Company, president of the Washburn & Moen Manufacturing Company, of Worcester, Mass., and chairman of the board of engineers of the United States Steel Corporation, died at the age of sixty, at his home in Worcester on Aug. 31. Mr. Daniels was known throughout the wire-manufacturing world as one of its most productive inventors, having taken out 151 patents in his forty years' service in the industry and having served as consulting engineer in the establishment of many of the largest steel plants of America. He was a native of Hanover, N. H., and after graduation at the Worcester Polytechnic Institute in 1873 entered the Washburn & Moen wire plant in that city as a draftsman. With the exception of a short time spent outside in the study of metallurgical chemistry, Mr. Daniels made his headquarters at Worcester until his death. He was an extensive traveler on both sides of the Atlantic, and supervised the erection of mills and machinery at Worcester, Waukegan, Ill., San Francisco, Birmingham, Ala., Gary, Ind., and Cleveland, Ohio. At Gary he was a prominent member of the board of consulting engineers in charge of the installation and design of that mammoth plant, and he served in a like capacity at the Duluth mills of the Minnesota Steel Company. In all, 143 plants were under his direction. He was the recipient of a gold medal at the Paris Exposition of 1900, and in 1909 he was decorated by King Oscar of Sweden. He was a member of many engineering societies in Europe and America. He is survived by a widow and three sons.

Construction

New England

WOODSVILLE, N. H.—The electric plant of the Woodsville Aqueduct Co., which was destroyed by fire in February, has just been rebuilt. The equipment consists of two 150-kw, three-phase, 60-cycle General Electric generators with direct-connected exciters; one 10-kw constant-current transformer for street circuit; one 150-hp Brown engine; one 150-hp waterwheel (Holyoke Machine Co.); one 165-hp S. Morgan Smith waterwheel; one Lombard waterwheel and governor for the Smith wheel. George E. Mann is engineer of power station.

FISHERVILLE, MASS.—The Fisherville Mfg. Co. is reported to be preparing plans for the construction of a transformer station to be used as an auxiliary to its present power plant.

MIDDLETON, MASS. — At a special town meeting held recently the proposition to purchase the local electric-light plant for $4,500 was carried.

EAST PROVIDENCE, R. I.—Work has begun on the erection of a substation for the Narragansett El. Ltg. Co. on Second Street, East Providence, to cost about $10,000. Energy for operating the station will be secured from the main plant in Providence.

ESSEX, CONN.—The Essex Lt. & Pwr. Co. has filed a certificate showing an increase in capital stock from $75,000 to $100,000.

KENT, CONN.—Steps have been taken to organize a company to operate an electric-light and power plant. The capital stock is placed at $3,000.

WINDSOR LOCKS, CONN.—A movement has been started by the Windsor Locks Business Men's Association for the installation of an ornamental street-lighting system on Main Street. Cluster lamps erected on ornamental standards are under consideration.

Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by the commissioner of docks, Department of Docks and Ferries, Pier A, foot of Battery Place, North River, borough of Manhattan, New York, until Sept. 9, for furnishing materials and labor required for track work and overhead trolley installation on the Thirty-third Street pier and adjacent upland, borough of Brooklyn (contract No. 1380). Blank forms and further information may be obtained and plans and drawings may be seen at the office of the department. Charles J. Farley is first deputy and acting commissioner of docks.

FLUSHING, N. Y.—The New York & Queens County Ry. Co. is planning to enlarge its substation on Lawrence Street in Flushing.

LOCKPORT, N. Y.—The Council has awarded the Lockport Lt., Ht. & Pwr. Co. a contract for street-lighting for a period of three years. Under the terms of the contract the company agrees to install a new street-lighting system.

MONTICELLO, N. Y.—The Public Service Commission has granted the Murray El. Lt. & Pwr. Co., of Monticello, permission to issue bonds to the amount of $50,000, the proceeds to be used for the purpose of paying indebtedness, to provide for working capital and new construction and equipment.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 4 for remodeling the fire-alarm system at the navy yard, New York, N. Y. Specifications may be obtained on application to the bureau or to the commandant of the navy yard named. The cost of the work is estimated at $3,080. H. R. Stanford is chief of bureau.

NEW YORK, N. Y.—Bids will be received by Joseph Johnson, fire commissioner, headquarters of the Fire Department, 157 East Sixty-seventh Street, New York, N. Y., until Sept. 9 for furnishing material and installing extensions to the fire-alarm telegraph system in the borough of the Bronx under Bronx contracts No. 2 and No. 3. Blank forms and further information may be obtained and plans and drawings may be seen at the office of the Bureau of Fire Alarm Telegraph of the Fire Department, 157 East Sixty-seventh Street.

PORT HENRY, N. Y.—The Port Henry Lt., Ht. & Pwr. Co. is building a concrete dam at North Pond for storage purposes. George H. Barwise is secretary.

SOLVAY, N. Y.—The Solvay Process Co. has awarded the McClintic, Marshall Co., of Pittsburgh, the contract for the steel-work in connection with its new boiler house in Solvay. The building will be 70 ft. by 250 ft. and will be equipped with five boilers having a rating of 6000 hp. A chimney 250 ft. high will be erected, probably of iron. Charles G. Herbert, acting chief engineer, has charge of the work.

ALLENTOWN, PA.—Bids will be received by the County Commissioners, Court House, Allentown, until Sept. 19 for furnishing material and labor for extensinon of the electric-light system in the Hospital Building at the Lehigh County Home, near Wescosville. Plans and specifications may be seen at the office of the County Commissioners, and copies can also be obtained upon deposit of $25, to be refunded upon return of plans. Bids should be addressed to H. C. Weinert, clerk.

INTERCOURSE, PA.—The Intercourse El. Lt., Ht. & Pwr. Co. has nearly completed its substation to connect with the 11,000-volt transmission line of the Edison El. Co. of Lancaster, transforming the energy to 2200 volts. When completed the company will close down its steam plant. The company is also extending its transmission lines to Vintage, Ronks and Bird-in-Hand to furnish electrical service in those towns. Enos L. Zimmerman is secretary and manager.

OIL CITY, PA.—Plans are being prepared, it is reported, by Day & Zimmerman, engineers, 608 Chestnut Street, Philadelphia, Pa., for the erection of a power house and plant at Oil City for the Citizens' Trac-Co., Oil City.

READING, PA.—The Metropolitan El. Co. will begin workk on the erection of a transmission line from its plant in West Reading to Lebanon to furnish energy for lamps and motors in that city. The line will be carried on steel towers erected on private right-of-way. The cost of the work is estimated at $150,000. Clarence C. Long, electrical engineer for the company, and W. S. Bartow, of New York, N. Y., will have charge of the work.

BUCKHANNON, W. VA.—The Buckhannon Lt. & Wtr. Co. expects to purchase within the next 30 days a 180-hp to 200-hp National gas engine and a 135-kw, three-phase generator (both second-hand); also a 1,000,000-gal. motor-driven pump (new) and switchboard for above equipment. J. G. Mayfield is general manager.

WHEELING, W. VA.—The Wheeling Valley El. Lt. & Pwr. Co. has applied to the County Commissioners for a 50-year franchise to erect high-tension transmission lines along the county roads in and out the pike district.

MONTEREY, VA.—The Highland Garage & Lt. Co., of Monterey, expects to purchase within the next two months wiring supplies, etc. Charles Lumsford is interested in the company.

ROCKY MOUNT, VA.—The Lt. & Pwr. Co., of Rocky Mount, expects to build within the next few months a small power dam and transmission line about 1½ miles in length and to purchase one water turbine, with governor. B. L. Fisher is manager.

STAUNTON, VA.—The Board of Aldermen has decided to establish a municipal electric-light plant, to cost approximately $23,000. The purchase of a site for the proposed power plant has been authorized.

WASHINGTON, D. C.—Tenders are invited by the Egyptian Ministry of the Interior for furnishing and installing an electric-light plant and distribution system in the town of Samanhour. For further information address No. 11,568, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the office of the superintendent of United States Capitol Building and Grounds, Washington, D. C., until Sept. 10 for lighting, heating and power system for the court house, Washington, D. C. Plans and specifications may be secured upon application to the above office, for which a deposit of $10 will be required, to be refunded upon return of plans. Elliott Woods is superintendent of United States Capitol Building and Grounds.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 27 for furnishing and installing four multiple CO_2 recorders of four units each with 14 recording gages, 14 auxiliary boiler-room indicators and 14 condensing filters and 14 recording flue-gas thermometers, all in central power plants, navy yards, Mare Island, Cal., and Puget Sound, Wash.; estimated cost is $3,500. Plans and specifications can be obtained on application to the bureau or to the commandants of the navy yards named. H. R. Stanford is chief of bureau.

WASHINGTON, D. C.—Bids will be received at the office of the superintendent of United States Capitol Building and Grounds, Washington, D. C., for interior wood trim and finish, interior plain and ornamental plastering, interior marble work, plate glass, extension of mail chutes and gravity conveyors, hardware, electric-lighting fixtures, plumbing and steamfitting material. Plans and specifications will be issued as soon as possible, together with information as to date of opening bids. Parties intending to submit bids are herewith notified that applications for plans and specifications for any or all of the above work can be filed with this office immediately. Elliott Woods is superintendent of United States Capitol Building and Grounds.

North Central

BAY CITY, MICH.—W. H. Fitzhugh, secretary of the Electric Light Department, is receiving bids for remodeling the pumping station into an electric-light plant. Clark & Munger are architects.

BLISSFIELD, MICH.—The Council has instructed Ray Ellis, superintendent of the municipal electric-light plant, to prepare estimates of the cost of enlarging the plant and the installation of additional machinery to provide for a 24-hour service.

CARSONVILLE, MICH.—The contract for the installation of a complete municipal electric-light plant has been awarded to the Detroit office of the Fairbanks-Morse Co.

CRYSTAL FALLS, MICH.—Bids will be received by the City Council of Crystal Falls, at the office of W. J. Gribble, city clerk, until Sept. 10 for the general construction, also heating, plumbing and electric wiring, of a new city hall building in Crystal Falls. Plans and specifications are

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on file at the office of the city clerk, Crystal Falls; also at the office of John D. Chubb, architect, Chicago Opera House, Chicago, Ill.; also at Builders' Exchanges, Milwaukee, Wis., St. Paul and Minneapolis, Minn. Copies of plans and specifications may be obtained upon application to the architect, for which a deposit of $25 will be required; specifications without plans, $10; said deposits to be refunded upon return of same.

DETROIT, MICH.—The Wayne County Creamery is planning to erect a new building on Henry Street, to cost about $500,000. A modern power plant will be installed. John C. Stahl is architect.

DETROIT, MICH.—Bids will be received by the Board of Education, Detroit, until Sept. 9 for erection of the George M. Condon School building and detached power house at the Boulevard and Vinewood Street. Bids will be received for the entire work, or separate bids will be received as follows: For general masonry work, general carpentry work, heating, plumbing and electrical wiring. Plans and specifications may be seen in the office of the supervisor of school buildings, Detroit. Charles A. Gadd is secretary of board.

JONESVILLE, MICH.—The Village Council has awarded contracts for a new 175-hp boiler for the municipal electric-light plant and for extension to power house to provide space for same and for extra coal storage.

LANSING, MICH.—The State Board of Auditors has decided to secure electrical service for the Capitol Building from the municipal electric plant. The Michigan Pwr. Co. has furnished the service in the past.

MUNISING, MICH.—The El. Lt. & Pwr. Co., of Munising, expects to install within the next six weeks one 150-hp tubular boiler. James Hosking is vice-president.

SAULT STE. MARIE, MICH.—The property of the Michigan & Lake Superior Pwr. Co., of Sault Ste. Marie, was purchased by A. S. Weil, of Philadelphia, Pa., representing the bondholders, at an auction sale held on Aug. 27 for $3,500,000. It is understood that the property will be taken over by the Michigan Northern Pwr. Co., recently organized. The new owners, it is said, expect to develop about 45,000 hp.

BLUFFTON, OHIO.—The Board of Public Affairs expects to purchase next spring two boilers having a rating of about 200 hp.

LOWELL, OHIO.—The Parkersburg, Marietta & Interurban Ry. Co. is contemplating the construction of a hydroelectric power plant on the Muskingum River, near Lowell, to cost about $200,000. C. C. Gallagher, of Marietta, is chief engineer.

NEW CUMBERLAND, OHIO.—The installation of a new street-lighting system in New Cumberland is under consideration.

PORT CLINTON, OHIO.—The Port Clinton El. Lt. & Pwr. Co. is remodeling its distribution system, changing to a three-phase, 60-cycle system with a 24-hour service. The company purchases energy from the Northern Ohio Ry. & Pwr. Co. C. A. Matthews is superintendent.

UPPER SANDUSKY, OHIO.—The proposition to issue $25,000 for the installation of a municipal electric-light plant will be submitted to the voters.

CAMPBELLSVILLE, KY.—A company is being organized under the name of the Campbellsville Wtr. & Lt. Co. to install and operate an electric-light plant here. The City Council has granted the company a franchise.

CARLISLE, KY.—The Carlisle El. Lt. & Pwr. Co. is contemplating the erection of a 10-ton ice factory.

ERLANGER, KY.—The Erlanger Lt. & Pwr. Co., recently organized, has been granted a franchise to construct and operate an electric-light system in Erlanger. A site for the proposed plant has been secured.

HARRODSBURG, KY.—Plans are being considered for increasing the output of the municipal electric-light plant.

HENDERSON, KY.—Contracts have been awarded by the City Council for additional equipment for the municipal electric plant as follows: To the Westinghouse El. Mfg. Co., for steam turbine and condenser, at $14,695; Babcock & Wilcox Co., for 400-hp boiler, at $5,691, and to the Heine Chimney Co., of Chicago, for erection of 225-ft. smokestack, at $6,077. L. P. Hite is superintendent of the municipal electric plant.

JEFFERSONVILLE, IND.—A proposition has been submitted to the City Council for lighting the streets of the city by Owen L. Carr, of Rushville, Ind. Mr. Rush, it is stated, will install a plant at once if he obtains the contract. The United Gas & El. Co., of Jeffersonville, now has the contract for street-lighting.

BUNKER HILL, ILL.—The electric light committee is contemplating the purchase of meters for the municipal electric-light plant within the next twelve months. Harry McPherson is chairman of committee.

CHICAGO, ILL.—Improvements will be made to Yates Avenue, the southeastern entrance to Jackson Park, involving an expenditure of about $35,000. The street will be paved and electric lamps installed as far south as the South Shore Country Club.

JACKSONVILLE, ILL.—The Jacksonville Ry. & Lt. Co. has recently closed a contract with Swift & Co. to furnish energy to the amount of 150 hp for its branch in Jacksonville. The company has also recently taken a contract for pumping the city water from deep wells, which requires 250-hp load 24 hours per day. W. B. Miser is general superintendent.

NEWTON, ILL.—The electric light commission expects to purchase a new generator for the municipal electric-light plant within the next few months. A new engine has recently been installed. When the new generator is installed a day service will be established. John W. Matheny is city clerk.

DODGEVILLE, WIS.—The Dodgeville El. Lt. & Pwr. Co. expects to erect within the next three months a smokestack or brick chimney and to purchase one horizontal tubular boiler. W. J. Pearce is manager.

EAU CLAIRE, WIS.—The Chippewa Valley Ry., Lt. & Pwr. Co., of Eau Claire, expects to build within the next three months an electric railway from Eau Claire to Altoona and to erect a 66,000-volt transmission line 6 miles long, 5 miles of 33,000-volt transmission line, and to reinsulate 25 miles of 66,000-volt transmission line; also to purchase one pair of 3600-hp waterwheels (50-ft. head), with governor. A. E. Pierce is assistant manager.

HUDSON, WIS.—The Burkhardt Milling & El. Pwr. Co., of Hudson, expects to erect within the next two months 22 miles of 13,200-volt transmission line, east through North Line, Roberts, Hammond and Baldwin; also to purchase one switchboard with instruments and 300 kva in 13,200-volt transformers. H. E. Zimmermann is superintendent and purchasing agent.

JANESVILLE, WIS.—The Janesville El. Co. expects to purchase within the next month one 400-kva, three-phase, 60-cycle, 2300-volt, 600-r.p.m. generator with switchboard panel. P. H. Korst is secretary.

LA CROSSE, WIS.—The City Council is reported to have decided to award the contract for energy for lamps and motors at the new municipal water plant to La Crosse Gas & El. Co.

LUCK, WIS.—At an election held Aug. 19 the proposition to issue $4,500 in bonds for the installation of a municipal electric-light plant was carried. Work will begin on construction of the plant immediately. As yet no engineer has been engaged. Andrew Pederson is village clerk.

MADISON, WIS.—The Chicago & Wisconsin Valley R. R. Co., of Madison, which was recently reorganized, has been granted the necessary franchises by various cities and counties on condition that within 60 days the company shows proof that $300,000 has been set aside to start construction and to pay debts contracted previous to the reorganization. The first line will be built from Madison to Portage, including street-car systems in both cities. About 250 miles of electric railway will ultimately be built radiating from Madison.

PRAIRIE DU CHIEN, WIS.—The plant of the Prairie City El. Co., which was recently destroyed by fire, was rebuilt temporarily and placed in operation in six days. The company has purchased a new generator. Contract for new building has not yet been awarded and date not yet decided upon. L. P. Haupt is superintendent.

SOLDIERS' GROVE, WIS.—The Soldiers' Grove El. Co. expects to purchase within the next two months about 200 incandescent lamps. Thomas O. Sims is manager.

SPOONER, WIS.—The city of Spooner has purchased 40 acres of land on the Namekagen River, 9 miles distant, where it proposes to build a hydroelectric power plant and transmit energy to Spooner for manufacturing purposes. The present municipal electric plant is driven by power from the Yellow River.

DULUTH, MINN.—The Duluth Edison El. Co. has recently purchased 38,000 lb. 0000 solid weather-proof wire to replace 4½ miles of single-phase No. 2 weather-proof lighting feeder in the new steel plant district beyond West Duluth. C. W. Higgins is assistant to manager.

GAYLORD, MINN.—The electric light committee expects to purchase within the next 30 days some incandescent lamps. F. J. Hecht is superintendent.

JORDAN, MINN.—The Jordan El. Ltg. & Htg. Co. is adding about 500 ft. of mains to its heating system.

KEEWATIN, MINN.—Bids will be received by the Village Council until Sept. 9 for furnishing and installing one reciprocating engine, generator, exciter, switchboard and equipment, plans and specfications for which are on file in the office of J. J. Roberts, village clerk.

AFTON, IA.—Beginning about Sept. 1, energy for operating the municipal electric-light system will be obtained from the plant of the Creston Mutual Lt. & Pwr. Co. in Creston, 10 miles west of Afton. F. A. White is city clerk.

ALBIA, IA.—We are informed that no definite action has yet been taken in connection with the installation of a municipal electric light plant in Albia. An engineer has not yet been engaged. C. C. Atchison is city clerk.

FAYETTE, IA.—The municipal electric light and water-works commission expects to purchase within the next six months one standpipe for water-works system. W. J. Irvin is superintendent.

MENLO, IA.—George C. Buckley & Co., owners of the local electric light plant, are installing a 60-hp engine and boiler. George C. Buckley is president and manager.

CHAFFEE, MO.—The Missouri Public Utilities Co., of Cape Girardeau, will extend its high-tension transmission line now furnishing energy to Illmo and Fornfelt to Chaffee. Energy for operating the entire service will be furnished from the plant in Cape Giraddeau. A. M. Tinsley, of Cape Girardeau is local manager.

COLUMBIA, MO.—We are informed that the installation of an electric plant at the University of Missouri is not contemplated in the near future. A site was purchased some time ago but will not be used for the present. Work is nearly completed on additions to the present plant. C. S. Lynch is superintendent of buildings.

JEFFERSON CITY, MO.—The contract for construction of power house and tunnel at the State Capitol Building has been awarded to A. Anderson & Co., of St. Louis, Mo., at $42,495.

VELVA, N. D.—Arrangements have been completed by O. J. Kaufman, of Hillsboro, who was recently granted a franchise, to establish an electric-light plant in Velva.

BRIDGEWATER, S. D.—The Bridgewater El. Pwr. Co expects to purchase within the next six months some transformers and meters; also some vacuum cleaners and washing machines. G. W. Laing is president.

MOBRIDGE, S. D.—The Mobridge El. Lt., Ht. & Pwr. Co. expects to purchase within the next 60 days equipment for central heating station, material for about 3 miles of line extension for the present lighting system, also equipment for ornamental street-lighting system (to cost about $1,500). B. S. Hill is proprietor.

SALEM, S. D.—The Salem Milling, Lt. & Htg. Co. has recently purchased a 54-in. by 18-ft. tubular boiler for its plant. L. V. Schneider is president.

STURGIS, S. D.—Beginning with Sept. 15, the Sturgis Pwr. & Lt. Co. expects to close down its local plant and to purchase energy from the water-power company. U. S. Allison is manager.

ATKINSON, NEB.—J. Skedla & Sons, owners of the local electric light plant, expect to erect within the next month an 80-hp oil engine and are now installing a new generator and switchboard.

STRATTON, NEB.—The village of Stratton contemplates removing the triplex pumps to a better water supply, which will necessitate the purchase of a 15-hp or 20 hp motor. Elmer E. Martin is engineer.

Southern States

LA GRANGE, N. C.—H. H. Hutton & Sons, owners of the local electric-light plant, expect to erect a new power house and install a new steel overshoot waterwheel. A. R. Hutton is manager.

OLD FORT, N. C.—William Robinson has purchased a water-power site on Curtis Creek, about 2 miles from Old Fort. It is understood that Mr. Robinson contemplates development of same.

KINGSTREE, S. C.—The Kingstree El. Lt. & Ice Co. is reported to have increased its capital stock from $15,000 to $25,000.

NEWBERRY, S. C.—The proposition to issue $30,000 in bonds to purchase the electric-light plant and water-works now being built in Newberry by the J. B. McCrary Co., of Atlanta, Ga., will soon be submitted to the voters.

LAKELAND, FLA.—The installation of an electric system at the Lakeland Dairy Farm is reported to be under consideration. For further information address A. J. McDonough.

HENDERSON, TENN.—At a municipal election to be held the last of October the proposition to issue $30,000 in bonds for the construction of a water-works system, also from $6,000 to $8,000 in bonds for sewers, will be submitted to the voters. If the bond election carries, the Priestley-Loyd Lt. & Pwr. Co. will build a new power house, to cost about $1,800. C. W. Priestley is president.

LEWISBURG, TENN.—The Lewisburg Lt. & Pwr. Co. expects to purchase equipment for increasing the output of its ice plant by 20 tons per day within the six months. J. B. Hardison is secretary and treasurer.

SEVIERVILLE, TENN.—Arthur Brown, of Knoxville, is interested in a project to establish an electric-light plant in Sevierville.

HOPE, ARK.—The managers of the water and light plant are building an addition to the power house of the municipal electric-light plant (20 ft. by 38 ft., brick and concrete) to provide space for pumps, and are now completing the installation of a new 600-ft. air compressor and a 300-kw. two-phase generator directly connected to a Corliss engine. Charles M. Richards is manager.

PRAIRIE GROVE, ARK.—The construction of a municipal electric-light plant and water-works system at a cost of $50,000 is under consideration.

GIBSLAND, LA.—The North Louisiana Lt. & Pwr. Co., of Arcadia, has submitted a proposition to the Town Council to furnish energy to light the streets of the town. The company also proposes to furnish electrical service to private consumers.

NEW ORLEANS, LA.—A contract has been closed whereby the New Orleans Ry. & Lt. Co. will extend its service to the plant of the Planters' Fertilizer Co. in Shrewsbury, a suburb of New Orleans. The contract calls for about 500 hp. The company will also furnish energy for lamps and motors for residents in that suburb and also to manufacturing enterprises.

RINGGOLD, LA.—A stock company is being organized by local citizens for the purpose of installing a water-works system. Plans are also being considered for establishing an electric-light plant.

LEHIGH, OKLA.—The Public Service Co., of Oklahoma, which recently purchased the municipal electric-light plant in Lehigh, expects to erect a 6600-volt transmission line from Coalgate to Lehigh to furnish energy to operate the local system. All material for the line has been purchased.

MEDFORD, OKLA.—The managers of the municipal electric-light plant expect to erect within the next two months a new power house and to purchase generating equipment, a six-panel switchboard and instruments and also one 6.6-amp. constant-current series tungsten regulating transformer. Charles Berger is superintendent.

COLORADO, TEX.—The Colorado El. Lt. Co. expects to install an oil engine within the next six months.

COMANCHE, TEX.—The Comanche Lt. & Pwr. Co. expects to purchase within the next few months a 125-kw to 150-kw single-phase generator and a tungsten-lamp street lighting system. E. W. Harris is manager and proprietor.

CONROE, TEX.—The Conroe Gin, Ice & Lt. Co. expects to establish a day service and to purchase machinery for an ice plant within the next 12 months. C. C. McDade is secretary and treasurer.

COOPER, TEX.—The Delta El. Mfg. Co. expects to purchase one 30-kw generator directly connected to a 40-hp or 50-hp engine (would prefer a good second-hand machine) within the next six months. The company has erected 2 miles of distribution lines within the last two months. R. J. Thomas is president.

LONGVIEW, TEX.—Bids will be received by the city of Longview, City Hall, Longview, until Oct. 8 for the construction of a mechanical filtration plant of 1,000,000-gal. capacity, a pumping and electric-light plant, and a discharge main 3½ miles long, to cost approximately $110,000. Complete plans and specifications may be seen at the office of the city secretary, Longview, or at the office of the Aetna Engineering Bureau, 17 North La Salle Street, Chicago, Ill. Plans may be obtained from the engineers upon payment of $2.50, which will not be refunded. G. A. Bodenheim is Mayor.

RUNGE, TEX.—At an election held Aug. 27 the proposition to issue $20,000 in bonds for the construction of an electric-light plant and water-works was carried. J. F. Murray is clerk.

SAN ANTONIO, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 25 for the installation complete of an electric elevator in the United States post office and court house at San Antonio, in accordance with specifications, copies of which may be had at the above office. O. Wenderoth is supervising architect.

SAN BENITO, TEX.—The franchise which was granted to the S. A. Robertson Co. a few months ago for the construction of an electric-light plant and telephone system has been declared forfeited. It is expected that a franchise will be granted to other parties.

SULPHUR SPRINGS, TEX.—B. F. Ashcroft & Sons, owners of the local electric-light system, are preparing to build an electric light and power plant and expect to purchase two 150-kw, 2300-volt, three-phase, 60-cycle generators (directly connected type); also engines, water-tube boilers and switchboard.

WEATHERFORD, TEX.—The capital stock of the City of Weatherford Wtr., Lt. & Ice Co., it is reported, has been increased from $80,000 to $90,000.

Pacific States

LEAVENWORTH, WASH.—The Tumwater Lt. & Wtr. Co., of Leavenworth, expects to purchase one carload of poles within the next six months. L. R. Hart is secretary.

PE ELL, WASH.—The Central Lt. & Mfg. Co., of Pe Ell, expects to extend its distribution lines throughout the surrounding farming country; also to purchase within the next 30 days a 50-kw, three-phase, 2300-volt generator and to establish a 24-hour service, and within the next five months to purchase 50 meters. L. A. Webb is secretary and treasurer.

TACOMA, WASH.—Options have been obtained by the Tacoma Ry. & Pwr. Co. on a site at the corner of Twelfth Street and Sprague, on which it proposes to erect a new power house, storage sheds and offices for headquarters in place of the present building on A Street in Tacoma.

ADIN, CAL.—The Pitt River Pwr. Co. has applied for permission to build and operate a power plant at Burney Falls. The present plans provide for the development of 1000 hp and eventually to expand to a larger system. The company now operates a small plant in Adin. E. M. Wilson, Lawrence A. Wilson, of Adin, and others are interested.

BERKELEY, CAL.—The city attorney has been instructed to sell bonds to the amount of $95,000 for the installation of a fire-alarm system, etc.

BURBANK, CAL.—The State Railroad Commission has granted the Burbank El. Lt. & Pwr. Co. permission to sell its entire system to the city of Burbank for $3,212.

HEMET, CAL.—Notice of appropriation of 10,000 in. of water at the South Fork of the San Jacinto River has been filed with I. S. Logan, county recorder, by Ralph Bandini, attorney, of Los Angeles. The application states that about 7000 hp will be developed at a cost of about $200,000. Energy generated at the plant will be used for pumping water and for lamps in the San Jacinto, Hemet and Perris Valleys.

LOS ANGELES, CAL.—The City Council has adopted the report of the public service committee recommending that a bond election be called as soon as possible to submit the proposition to issue $6,500,000 in bonds for the completion of the aqueduct power project and the electrical distribution system in connection with the power project.

OAKLAND, CAL.—The State Railroad Commission has granted the Oakland, Antioch & Eastern Ry. Co., of Oakland, permission to issue $1,000,000 in bonds, the proceeds to be used for the construction of an electric railway from Bay Point to Sacramento.

RIVERSIDE, CAL.—A merger of four power systems, which will furnish energy to operate industries in western Nevada, the eastern portion of California and a large part of southern California, has been announced by Delos Chappell, president of the Southern Sierras Pwr. Co. The various systems will be connected by the erection of a transmission line from Bishop and Lundy Lake. The full connection will be effected by the construction of a line from Bishop to Long Valley by the Silver Lake Pwr. & Irrig. Co., and by an extension to be made by the Pacific Pwr. Co. from Long Valley to Lundy Lake. The Silver company has power projects on the Ownes River, while the Pacific company has its plant on Lundy Lake. The parent company is the Nevada-California Pwr. Co., which gets its energy from five hydroelectric plants on Bishop Creek, also the source of supply for the Southern Sierras Pwr. Co.

SACRAMENTO, CAL.—The city commissioners have authorized the extension of the electrolier lighting district from Twelfth to Sixteenth Street on J and K Streets. Flaming-arc lamps will be erected along the cross streets. The total cost of the extension is estimated at $12,806.

ASHTON, IDAHO.—The Ashton & St. Anthony Pwr. Co. has applied to the State officials for permission to build a dam on the Snake River, 2 miles west of Ashton.

SHOSHONE, IDAHO.—We are informed that the local substation of the Great Shoshone & Twin Falls Lt. & Pwr. Co. was not destroyed by fire, as reported in the issue of Aug. 23. The 44,000-volt bushings on incoming lines of the substation were destroyed by lightning.

BOUNTIFUL, UTAH.—Arrangements have been made by the Utah Lt. & Ry. Co., of Salt Lake City, for the construction of a substation in Bountiful. The equipment will consist of a 500-kw General Electric motor-generator (direct-current output), switchboard complete for alternating-current and direct-current machine and alternating-current and direct-current feeder panels, and four 300-kva transformers. Approximately 11 miles of overhead transmission line will be erected. Contracts have been awarded for the work.

SALT LAKE CITY, UTAH.—A movement has been started by the Salt Lake Real Estate Association to persuade the city of Salt Lake City to erect a municipal electric-light plant on City Creek Canyon to supply energy for street-lighting. W. G. Tuttle is interested in the project.

WARREN, ARIZ.—The Warren-Bisbee Ry. Co. expects to purchase a 5-kw or 10-kw transformer within the next month. The C. & A. Mining Co. will furnish energy to operate the railway system. Jesse Yoakum is superintendent.

ALAMOSA, COL.—The Mutual El. Lt. & Pwr. Co., of Alamosa, expects to purchase switches to change its switchboard from two-phase to three-phase, also totalizing recording wattmeter for entire output, two carloads of poles and probably one tub transformer next spring. H. A. Goodridge is manager.

FORT LUPTON, COL.—The Fort Lupton Lt. & Pwr. Co. is installing a 50-hp General Electric motor to operate the pumps at the municipal water-works system. The company expects to place orders soon for heating and cooking appliances for the holiday trade. D. W. McGee is local manager.

STEAMBOAT SPRINGS, COL.—The Steamboat Springs El. Co. expects to erect ½ mile of high-tension line to the mill of the Sarvis Timber Co. W. L. Carver is superintendent.

SEARCHLIGHT, NEV.—The forty-stamp mill, engine room and electric plant at the Quartet Mine was destroyed by fire on Aug. 20, causing a loss of about $115,000.

AZTEC, N. M.—The Aztec Lt. & Pwr. Co. has recently installed a new boiler and engine in its power house. W. Goff Black is manager.

Canada

POINT GREY, B. C.—The City Council has decided to engage an engineer to make investigations and report on the cost of the construction of a municipal electric-light plant.

VANCOUVER, B. C.—Mayor Baxter is considering a proposition for the construction of a hydroelectric power plant to furnish energy for lamps and motors for this city. The plan contemplates the construction of dams on Seaton Lake and Bridge River, which, it is estimated, would develop 250,000 hp.

WINNIPEG, MAN.—Tenders will be received by the chairman of Board of Control at the office of M. Peterson, secretary, until Sept. 20, for furnishing material and labor necessary for the erection of a duplicate transmission system on the present right-of-way of the city of Winnipeg, between Point du Bois and Winnipeg. Instructions to bidders, plans and specifications and form of tender may be obtained at the City Light and Power Department, 54 King Street, Winnipeg.

BRANTFORD, ONT.—Arrangements have been completed whereby the high-tension transmission line of the Hydro-Electric Power Commission of Ontario from the Brant substation will be erected on the right-of-way of the Lake Erie & Northern Ry. Co. into the city of Brantford. Negotiations are also under way for erecting the high-tension line for Paris over the right-of-way of the railway company.

NIAGARA FALLS, ONT.—The City Council has adopted a resolution authorizing the expenditure of $7,215 for improvements and extensions to the electric-lighting system.

TORONTO, ONT.—The Hydro-Electric Power Commission of Ontario has definitely decided upon the route for the transmission line between Chatham and St. Thomas. Right-of-way has been secured and work will be started at once. Material for the line has already been purchased.

WALKERVILLE, ONT.—Arrangements have been made whereby the Edison Illg. Co. of Detroit and the Walkerville Lt. & Pwr. Co. will within a short time control the electric lighting of an extensive area in Essex County. The Edison company recently purchased power plants in Harrow, Leamington, Essex and Kingsville; it also purchased a site for a power plant in Sandwich and obtained permission to erect power cables across the river from Delray to Sandwich.

New Incorporations

COLUMBIANA, ALA.—The Columbiana Ice, Lt. & Pwr. Co. has been incorporated by J. M. Crump and others. The company is capitalized at $25,000 and proposes to generate and distribute electricity for lamps and motors.

SOPER, OKLA.—The Soper El. Co. has been incorporated with a capital stock of $4,500 by W. F. Breathwit, A. J. Steen and J. Breathwit.

STAYTON, ORE.—The West Stayton Pwr. & Ry. Co. has applied for a charter to build an electric railway between Stayton and Salem. The company is capitalized at $100,000 and the incorporators are S. N. Arnold, E. O. Stadter and Grant Thomas.

Directory of Electrical Associations, Societies, Etc.

Alabama Light and Traction Association. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala.

American Association for the Advancement of Science. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

American Electric Railway Accountants' Association. Secretary-treasurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J. Annual convention, Atlantic City, N. J., Oct. 13-17.

American Electric Railway Association. Secretary, H. C. Donecker, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 13-17.

American Electric Railway Engineering Association. Secretary, H. C. Donecker, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 13-17.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Semi-annual meeting, Denver, Sept. 9-11.

American Electro-Therapeutic Association. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

American Institute of Consulting Engineers. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio. Annual meeting, Atlanta, Ga., December.

American Society for Testing Materials. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, Edwin A. Scott, 29 West 39th St., New York.

American Water Works Association. Secretary, J. M. Diven, 47 State St., Troy, N. Y. Annual meeting, May, 1914.

Arkansas Association of Public Utility Operators. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, May, 1914.

Association of Edison Illuminating Companies. Secretary, Geo. C. Holberton, Pacific Gas & Electric Co., San Francisco, Cal. Annual meeting, Cooperstown, N. Y., Sept. 8-11.

Association of Iron and Steel Electrical Engineers. Secretary, James Farrington, Steubenville, Ohio. Annual meeting, New York, Sept. 22-27.

Association of Railway Electrical Engineers. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago. Annual meeting, Chicago, Oct. 20-24.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, New Orleans, May 19-22, 1914.

California Electrical Contractors' Association. Secretary, W. S. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, H. G. Martin, Toronto Electric Light Co., Ltd., Toronto, Can.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col. Annual meeting, Denver, Oct. 6.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, Thomas F. Kennedy, 900 15th St., Denver, Col. Annual meeting, Denver, Oct. 6.

ELECTRIC CLUB OF CHICAGO. Secretary, Fred M. Rosseland, Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER BOSTON. Secretary, R. S. Hale, 39 Boylston St., Boston.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE CITY OF CHICAGO. Secretary, M. N. Blumenthal, 179 West Washington Street. Meets at noon on the second and fourth Wednesday of each month at 424 South Wabash Ave.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago. Annual meeting, Chicago, November.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa.

ELECTRICAL DEVELOPMENT ASSOCIATION, INC. Secretary, Zenas W. Carter, 53 State St., Boston, Mass.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Fall meeting, Niagara Falls, Canada, Sept. 9-11.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d Street, New York. Annual convention, Chicago, Oct. 27 and 28.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, L. L. Edgar, 39 Boylston St., Boston.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York. Annual meeting, New York, October.

FARADAY ELECTRICAL ASSOCIATION. Secretary, W. J. Collins, 1129 Masonic Temple, Chicago. Meets at noon on the first and third Wednesday of each month at Planters' Hotel.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual meeting, May, 1914.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh. Annual meeting, Pittsburgh, Sept. 22-26.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, J. V. Zartman, 49 Lombard Building, Indianapolis, Ind. Annual meeting, Indianapolis, Sept. 24 and 25.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St., New York. Annual meeting, New York, January, 1914.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNAL-COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, Dr. E. B. Rosa, Bureau of Standards, Washington, D. C. San Francisco, Sept. 13-18, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 6-11, 1915.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary, H. B. Maynard, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, Cedar Rapids, April 23, 1914.

JOVIAN ORDER. Jupiter (president), F. E. Watts, 239 West 39th St., New York; Mercury (secretary), E. C. Bennett, St. Louis, Mo. Annual meeting, Hotel Astor, New York, Oct. 14-16.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan. Annual convention, Hutchinson, Oct. 9 and 10.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn. Annual meeting, Minneapolis, March, 1914.

MISSISSIPPI ELECTRIC ASSOCIATION (affiliated with the National Electric Light Association). Secretary-treasurer, Frank J. Duffy, Natchez, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis. Annual meeting, May, 1914.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, Philadelphia, May, 1914.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, J. F. Becker, 1170 Broadway, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, R. E. Russell, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC SECTION. Secretary, S. A. Sewall, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual convention, Burlington, Vt., Sept. 17, 18, 19.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NORTHWEST SECTION. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash. Annual meeting, Seattle, Wash., Sept. 10-12.

NATIONAL ELECTRIC LIGHT ASSOCIATION, SOUTHEASTERN SECTION. Secretary-treasurer, A. A. Wilbur, Columbus, Ga.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago. Annual meeting, June, 1914.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk Street, Boston, Mass. Open meeting, New York, March, 1915.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, Richard Valentine, Janesville, Wis.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, H. A. Faulkner, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, 598 Broadway, Albany, N. Y.

NEW YORK ELECTRICAL CREDIT ASSOCIATION (affiliated with the National Electric Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Annual meeting, Dec. 9.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York. Annual meeting, New York, June, 1914.

NORTHWESTERN CEDARMEN'S ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn. Annual meeting, Jan. 6, 1914.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Annual meeting, Columbus, Ohio, Nov. 20-22.